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THE TREATMENT OF DISEASES OF THE EYE

THE TREATMENT OF DISEASES OF THE EYE

BY

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AUTHOR'S PREFACE

THE present book aims at supplying the practitioner with some hints and indications for the treatment of the diseases of the eye. The numerous excellent text-books can hardly give this subject all the attention which it deserves, for on the one hand they have to deal with a vast number of subjects and can therefore only sketch the treatment in broad lines, while on the other hand it is scarcely possible for the practitioner to procure the latest editions so as to keep himself in touch with recent advances and innovations. The author has therefore set himself the task of putting together the results of some years of experience in a short yet detailed book of reference.

Since a rational line of treatment must be evolved from a thorough comprehension of the disease under consideration, it has seemed to him necessary in certain places to add notes on matters of importance in diagnosis, and especially in differential diagnosis.

The treatment of diseases of the eye is largely, and in many cases exclusively, operative. This book, however, does not pretend to deal with the operative surgery of the eye, and in order that it may not exceed due limits the author has contented himself with merely naming the operations required.

He believes that minute descriptions of technical methods may be the more justifiably excluded, since these would not enable the inexperienced to undertake operations in which only considerable skill and experience can command success. On the other hand, by pointing out what operation is indicated, some guidance is given as to when the treatment should be transferred to more practised hands.

It would afford the author much pleasure if he could believe that he had attained this aim, and had produced a work in some degree useful to his fellow-practitioners. At the same time he would request his readers to draw his attention to any defects in the book.

TRANSLATORS' PREFACE

In presenting Dr. Hanke's manual of diseases of the eye to English-speaking readers the translators feel that no apology is required. It is hoped that it may supply to the student and general practitioner a somewhat full, yet condensed summary of modern ocular therapeutics, together with some notes on matters of importance in diagnosis and differential diagnosis. The book provides a *résumé* of the methods adopted in Professor Fuchs's Clinic at Vienna, and it is therefore believed that ophthalmic surgeons will also find it of interest and utility.

The original text has been closely followed except that in a few unimportant instances British pharmacopœal preparations have been substituted for Austrian—a change necessary to the general usefulness of the book. Formulæ which are directly transferable from grammes and cubic centimetres into percentages have been left unchanged, but wherever necessary the approximate English equivalents have been given—*e.g.*, 0·25 to 1 c.c.—m. 4 to m. 15, 3 to 10 grms.—dr. 1 to dr. 3. It may further be noted that aluminium subacetate lotion (Burow's solution), which is frequently mentioned in the text, may be adequately replaced by the simple antiseptic lotions more commonly used in England.

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THE EXAMINATION OF THE EYE

Rational treatment can only be founded upon exact investigation of the diseased organ. The eye, built up of various tissues, reacts to one and the same pathological stimulus in quite different ways, which are almost specific for the individual membranes, manifesting themselves by definite objective symptoms. Knowledge of these symptoms is therefore essential to correct judgment of the underlying process. Further, it is imperative always to carry out the examination in the same systematic fashion, so as to avoid the possibility of overlooking or forgetting any point of importance.

After recording the *History and General Condition*, including visible signs of past or present disease—glandular swellings, exanthemata, jaundice, scrofulous or small-pox scars, flat nose, etc.—the examination of the eye is proceeded with, progressing from the more superficial to the deeper parts.

Lids.—Examination of the lids includes :—

Position and Mobility—ectropion, entropion, trough-shaped curvature (trachoma).

Width of and Ability to close the Palpebral Aperture—lagophthalmos, blepharospasm, ankyloblepharon, blepharophimosis, ptosis.

Conditions of the Edges of the Lids—scales, discharge, crusts, scabs (these should be softened with vaseline and then removed with moist cotton wool), redness, swelling, ulcers, abscesses, thickening, parasites, rounding of the lid margins, defective apposition of the lid margins to the globe, eversion or inversion of the puncta, etc.

Position and Form of the Cilia—trichiasis, loss of lashes, curved or broken lashes, fine hairs, etc.

Investigation of the *Skin of the Lids* includes :—

Inspection : œdema, inflammation, tumours, abscesses, ulcers, erysipelas, suffusion, wounds, scars.

Palpation : œdema frigidum (examine the urine) or callidum, resistant or painful spots, palpation of the orbital margin, tumours of the skin or tarsus.

Investigation of the Condition of the Inner Canthus (for tumor lacrymalis, abscess, fistula, scars) *must never be omitted* ; most important is the effect of *pressure on the lacrymal sac* (for regurgitation of tears, mucus, or pus).

(N.B. The lacrymal sac lies behind the inner palpebral ligament, which is made prominent by stretching the lids horizontally, either by pulling the skin inwards at the root of the nose, or outwards at the outer canthus.)

The inner or conjunctival surface of the lids is next examined. This is exposed on the lower lid when the lid is pulled downwards whilst the patient looks up. The upper lid must be everted : the patient looks well down, the free edge of the lid is seized and pulled downwards, whilst the thumb or finger of the other hand, or a pencil or glass rod is pressed upon the skin over the upper edge of the tarsus—about 1½ cm. from the edge of the lid ; the edge of the lid is then turned upwards through an angle of 180°. When the lids are small, or there is strong blepharospasm, this method fails ; the lids can then generally be everted by pulling the lids apart with the fingers laid on flat, whilst slight pressure is exerted upon the margins of the orbit. The *surface of the tarsus* is then investigated for hypertrophy, scars, foreign bodies, trachoma granulations, infarcts of the Meibomian glands, chalazia, ulcers, symblepharon, etc. It is often necessary to bring the *upper fornix* into view. This somewhat difficult manœuvre is performed as follows : A smooth metal, glass, wooden, or ivory rod, or a pencil, is introduced behind the everted upper lid, which is again rotated upwards.* This

* A useful method for exposing the upper fornix is as follows : the upper lid having been everted, the patient is told to look well down ; firm, but gentle, pressure is then exerted on the globe through the lower lid in a direction upwards and backwards ; the fornix will then spring forwards into view.—Trs.

exposes granulations, scars, foreign bodies (especially lime). In the presence of rhagades and blepharospasm the opening of the lids must be conducted slowly and with great care. If the lid margins and cilia are stuck together by much purulent discharge—blennorrhœa, diphtheria—the surgeon should not approach too near, or should guard his eyes by large protective spectacles, as the secretion frequently spurts out.

Conjunctiva. Then follows examination of the conjunctiva for the nature and amount of discharge, swelling, chemosis, injection, presence of foreign bodies, trachoma granulations, papillæ, scars,* croupous or diphtheritic membranes, ulcers, wounds, adhesions, ecchymoses, cysts, tumours, pigmentation —argyrosis, pigmented spots or tumours—etc.

We come now to the examination of the *eyeball*, and note :—

Position : exophthalmos, enophthalmos, strabismus.

Size : buphthalmos, atrophy, phthisis bulbi.

Shape : grooving by the straight muscles in atrophy.

Mobility.

The latter is examined thus : The patient, keeping his head stationary, is told to follow with his eyes the surgeon's finger moved in a horizontal and vertical direction at a distance of not less than 25 cm. from him.

In the **Conjunctiva bulbi**, conjunctival and ciliary injection, pustules, phlyctens, pigmentation, ecchymosis, xerosis, tumours, wounds, ulcers, scars, symblepharon are to be noted. Pinguecula, when the conjunctiva is injected (ophthalmia

* Scars, according to their depth, are bluish, grey, or dead white. The surface of the conjunctiva over them has a tendinous appearance. Their form and extent depend upon their ætiology. Thus linear scars in the sulcus subtarsalis of the upper lid parallel to the margin are characteristic of trachoma and of the slighter action of caustics. Reticular, more diffuse scars, on the inner surface of the upper lid, result from the severe action of caustics, old trachoma, blennorrhœa, and diphtheria. Linear cicatrices at right angles to the lid margin remain after incision and evacuation of chalazia.

Scars from caustics in the lower lid are usually more extensive, because the caustic remains longer in contact with the conjunctiva here.

Diphtheritic membranes are distinguished from scars on the one hand by simultaneous presence of severe inflammatory symptoms in the surrounding tissues, and on the other hand by their yellowish-grey colour and dull uneven surface.

catarrhalis), appears as a triangular, yellowish-white spot on both sides of the cornea, with a somewhat uneven but shiny surface.

In the **Sclerotic** bluish-red scleritic nodules, slate-grey ectasiæ and scars come under observation.

The examination of the **Cornea** demands great care. First, abnormalities in *Size and Shape* (hydrophthalmos) are noted; next, the *Brightness* is tested by oblique illumination (best by holding a convex lens at such a distance that the focus of the rays is at the level of the surface of the cornea), and by the corneal reflex (the patient follows the movements of the finger held at a distance of 25 to 30 cm. away, and the surgeon notes the image of a window, or other bright object formed by the convex surface with regard to its distortion, diminution in size, etc.). Dulness of the reflex is a sign of inflammation of the cornea, or iris, or of glaucoma.

Smoothness: depressions, involving the epithelium only, or also the substantia propria, elevations.

Curvature: increased or diminished, as shown by profile view, and rapid diminution in size of the corneal image corresponding with the ectasia.

Transparency: the size, shape, and details of any opacities; their superficial or deep situation, as shown by oblique illumination, and examination with the corneal loupe.

Sensitiveness: this varies within normal limits; it is diminished or even lost in glaucoma absolutum, keratitis neuroparalytica, herpes zoster.

Presence of Vessels: superficial vessels can be followed from the conjunctiva bulbi over the limbus, and branch in a tree-like manner; deep vessels stop short at the corneal margin, are deep red, have a straighter course, branch at acute angles —brush-like.

Anterior Chamber. *Depth*: inequality—partial bulging forward of the iris, cysts of the iris, subluxation of the lens; increase—aphakia, dislocation of the lens; diminution—iris bombé, glaucoma.

Contents: blood, pus, foreign bodies, cloudiness of the aqueous.

Iris. *Clearness of the Pattern.*

Change of Colour: like blotting-paper in atrophy, greenish in hyperæmia and iritis, greenish-brown in siderosis.

Position: anterior and posterior synechiæ, tremulousness in aphakia and dislocation of the lens.

Nodules: tubercle, condylomata, gummata, sarcomata.

Ectropion of the retinal pigment layer.

Pupil. *Dilatation*: glaucoma.

Shape: anterior and posterior synechiæ, coloboma, iridodialysis, ruptures of the sphincter.

Colour: congenital or inflammatory pupillary membrane, partial or total opacity at or behind its level.

Reaction: this gives important information with regard to general disease. We distinguish *direct contraction to light* (alternate lighting and shading with the hand or other opaque body), *consensual or synergic reaction* (dilatation on covering, constriction on illuminating, the other eye), *contraction associated with convergence and accommodation* (the patient looks into the distance and then suddenly fixes a finger held at 10 to 15 cm. away; the phenomenon is less distinct if the object fixed is gradually brought nearer). The consensual reaction is important in the diagnosis of amaurosis: if the pupil of the other eye dilates on covering the eye supposed to be amaurotic, perception of light at least is still present. Positive consensual combined with absence of direct reaction to light (reflex immobility of the pupil) is a symptom of certain nervous diseases—tabes, paralysis progressiva.

Lens. *Opacity*: this may be partial or complete; position and form should be noted (see Lens), and whether a shadow is cast on the lens by the iris. These points are investigated by oblique illumination and by the ophthalmoscope.

Diminution in Size: the edge of the lens may be visible in a coloboma.

Change in Position: shown by tremulous iris, deep anterior chamber, absence of the posterior lens reflex when the lens is dislocated into the vitreous, under the conjunctiva, or has been removed; visibility of the edge of the lens in the pupil; localised tremulousness of the iris indicates subluxation.

The examination of the **Vitreous, Choroid, Retina,** and **Optic Nerve** requires the use of the ophthalmoscope.

The testing of the **Intraocular Pressure** is of special importance, and should never be neglected (cf. "Glaucoma").

Subjective Testing of the eye comprises the investigation of *central and peripheral vision,* and *light sense.*

Central vision involves the determination of the refraction, accommodation, and visual acuity, for which purpose special experience is necessary. It need only be pointed out here that errors of refraction are often responsible for conjunctivitis, obstinate photophobia, and asthenopia, which should be treated by proper correction.

Peripheral vision is investigated by taking the field of vision. Exact results can only be obtained by the perimeter; but a rough idea, often of great value to the practitioner, may be arrived at by testing with the hand. Patient and surgeon are placed opposite each other; the patient fixes with one eye (the other being covered) the opposite eye of the surgeon—*i.e.*, the patient's right eye fixes the surgeon's left. The surgeon now determines the limits of the field of vision by gradually bringing his hand inwards from the periphery. The patient must at once say when it becomes visible. The surgeon therefore possesses in his own field a measure of any contraction which may be present. This, too, is the only possible method when vision is so reduced that small objects can no longer be perceived (glaucoma, optic atrophy, cataract). If vision is reduced to mere perception of light, the examination must be undertaken with a candle flame in a dark room, in which case, however, care must be taken that the patient does not look directly at the light.

In cases of cataract and advanced glaucoma the utility of an operation depends upon the result of this investigation, *i.e.*, upon the determination of the *projection of light.* The patient, who must keep the eye directed straight forwards, is requested to indicate exactly the direction of a source of light (candle) which is held in various positions before the eye, and it is best in order to avoid mistakes that he should point to it with his

finger. If by repeated examination the projection is found to be good, a satisfactory result may be expected from operation, since uniform and good functional activity of the retina and optic nerve may be inferred.

Another somewhat rough method of taking the field of vision is as follows: The patient stands about 30 cm. from a blackboard, upon which a fixation point is marked with chalk; from the periphery a luminous or coloured object, its size depending upon the visual acuity, is slowly brought towards the centre. In this manner circumscribed defects of the field of vision—scotomata *—can be demonstrated.

The examination of the *Light Sense* requires special instruments (photometer), for the description and mode of use of which the larger text books must be consulted.

In order to avoid repetition it is advisable before speaking of the treatment of the individual diseases to mention some common therapeutic agents, which demand a certain technical skill in their use.

* The pathological changes in the field of vision comprise:

1. *Peripheral Contraction*, which may be uniform (*concentric* contraction of optic atrophy) or localised (hemiopia=absence of half the field of vision, the lesion being in the optic tract, or higher, as far as the cortex; sector-shaped defects also occur from similar lesions and as a precursor of a complete hemiopia, as well as in embolism of a branch of the central artery of the retina, and detachment of the retina. A peripheral contraction, which commences on the nasal side and remains more marked in that situation, is characteristic of glaucoma, as distinguished from the concentric contraction of optic atrophy, hysteria, neurasthenia.

2. *Scotomata*, or insular defects. These are either irregularly scattered over the whole field of vision (choroiditis, retinitis), or involve the fixation point, more particularly the area between it and the disc (central, paracentral scotomata), and are characteristic of retrobulbar neuritis, especially the intoxication amblyopias (alcohol, nicotin, diabetes). In central choroiditis or retinitis, often the result of myopia, the scotomata are naturally also central.

One distinguishes:

Positive Scotomata=dark spots in the field of vision perceptible to the patient himself (opacities in the media, choroiditis, retinitis).

Negative Scotomata=localised areas in the field of vision, within which perception is completely absent (absolute negative scotoma), or is markedly diminished (relative scotoma); they are found for the most part only on taking the field of vision, and should always be sought for in cases of amblyopia.

MASSAGE

Manual massage is almost exclusively employed; instrumental massage is indeed used by some surgeons, but requires special and expensive instruments, and opinions as to the results are still much at variance.

Massage is carried out as follows: With the thumb and index finger one of the lids is grasped near its free border, and the cornea is rubbed quickly and with moderate pressure in a radial and circular direction (Pagenstecher). A simpler method, and one more easily performed by the patient himself, is to massage the eye with the tip of the finger smeared with vaseline and laid upon the upper lid. Massage should be continued for about three minutes one to three times a day. Ointments are used to combine mechanical and chemical actions; they are introduced into the conjunctival sac with a small glass rod after drawing down the lower lid.

Massage is employed to clear up corneal scars, to hasten absorption of scleritic and episcleritic nodules, as well as sometimes inflammatory infiltrations of the cornea, to disperse œdema of the lid, to soften and make more elastic deep scars of the skin of the lid (after gangrene, etc.); in the last two instances light pressure is exercised from the lid border towards the margin of the orbit. After subconjunctival injections massage is indicated to disperse the injected fluid. In thickening of the tarsus (trachoma) the whole lid may be massaged with advantage between the fingers, or with a glass rod wrapped round with sal alembroth wool applied to the tarsus of the everted lid. In this case the use of cocain (2 per cent.), and the subsequent application of cold compresses are requisite.

Deep massage, employed in thrombosis of the retinal veins and embolism of the central retinal artery, differs from that already mentioned in that greater pressure is exerted, but not so much as to cause pain.

INJECTIONS

(*a*) *Subconjunctival*: in inflammations and opacities of the cornea, inflammations of the choroid, retina, optic nerve, opacities of the vitreous.

The following are used as injections :—

1 in 1000 perchloride of mercury solution (0·2 cc.—m. 4).
Cyanide of mercury 1 in 5000 of 2 per cent. sodium chloride (0·25 to 1 cc.—m. 4 to m. 15).
2—5—10 per cent. salt solution (0·5 to 1 cc.—m. 8 to m. 15).
1 per cent. hetol (*i.e.* sodium cinnamate) solution (0·5 to 1 cc.—m. 8 to m. 15).

℞ Iodini 0·01—0·02
Pot. iod. 2·0
Aq. dest. 30·0
} 1 cc.—m. 15.

10 per cent. Iodipin * (0·25 to 0·5 cc.—m. 4 to m. 8).

It is well to add to all these injections 1 to 2 per cent. cocain or 1 per cent. eucain, except in the case of iodipin.

After washing out the conjunctival sac with 3 per cent. boracic acid solution or 1 in 4000 hydrarg. perchlor. and cocainisation, the injection should be made as far as possible from the limbus, so as to avoid necrosis. The point of the syringe should be directed backwards.

After the injection the fluid is dispersed by massage, and a bandage applied. If there be much pain, cold compresses are used. Some œdema remains at the spot for a considerable time, often for several days ; ecchymoses also frequently occur. Circumscribed necrosis sometimes occurs at the site of injection after the use of sublimate, especially if it is made too near the limbus. In such cases the injection is naturally not repeated or is made at a different place.

After injections of iodipin, fat collects under the conjunctiva or skin of the lid, in the form of irregular nodules of yellowish white colour, disappearing only after a long time.

(*b*) *Intramuscular sublimate injections*—in syphilitic inflammatory processes. Before each injection the urine should be tested for albumen (this should also be done before commencing treatment by diaphoresis), the state of the digestive organs should be examined, and any salivation and swelling or redness of the gums looked for. Carious teeth should, if

* Prepared by repeated iodisation of sesame oil by means of iodine monochloride in alcoholic solution.—Trs.

possible, be extracted and tartar removed. Before each injection the spot selected must be cleansed with soap, alcohol, sublimate solution, and ether.

The place chosen for the injection may be in the skin of the back, a fold being raised about three finger breadths from the middle line, or in the nates four finger breadths behind the great trochanter, the needle being sent in vertically here to a depth of 2 to 3 cm. without raising a fold of skin. It is best not to use massage after these injections. Each subsequent injection should be made about 4 cm. distant from the previous one. The puncture should be covered with some iodoform collodion.

Injections: 1—3—5 per cent. hydrarg. perchlor. with 1—3—5 per cent. sod. chlorid. (1 cc.—m. 15 daily, every third, or every seventh day respectively).

Hydrarg. formamid. 1 to 2 per cent. (1 cc.—m. 15 every second day).

Hydrarg. succinamid. 1 per cent. with 1 per cent. cocain (1 cc.—m. 15 every second day).

℞ Hydrarg. salicyl. . . . . 1·0
Paraffin liquid. . . . . 10·0
S. 1 cc.—m. 15 every fifth or seventh day.

℞ Hydrarg. thymolacetat. . . . . 1·0
Paraffin liquid. . . . . 10·0
S. 1 cc.—m. 15 every fifth or seventh day.

℞ Hydrarg. oxid. flav. . . . . 0·5
Paraffin liquid. . . . . 10·0
S. 1 cc.—m. 15 every fifth or seventh day.

℞ Hydrarg. bicyan. . . . . 0·1
Glycerin . . . . . 2·0
Aq. destill. . . . . 18·0
S. 1 cc.—m. 15 daily.

℞ Hydrarg. sozoiodol. . . . . 0·8
Potass. iodid. . . . . 1·6
Aq. destill. . . . . 10·0
S. 1 cc.—m. 15 daily.

The careful cleansing of the mouth is never to be neglected. It must be frequently washed out with potass. chlorat. (1 to

2 per cent.), potass. permanganat. (a solution of the colour of dilute red wine), or

℞ Thymoli . . . . . 0·5
Mentholi . . . . . 1·0
Tct. eucalypti . . . . . 10·0
Alc. absolut. . . . . 50·0
S. 4 to 5 drops in a glass of water.

The teeth should be cleaned with tooth-powder after every meal. If gingivitis is present the gums may be painted with

℞ Tct. krameriæ
Tct. gallarum . . . . . āā 20·0
Tct. myrrhæ . . . . . 10·0

BANDAGES

1. An *occlusive* bandage is applied in corneal inflammations and in iritis. A circular piece of linen or gauze of the size of the orbital aperture is laid upon the closed lids; upon this a pad of cotton-wool is placed, which reaches to the forehead above and the cheek below; this is secured by a strip of adhesive plaster from the root of the nose to the cheek; over this, either a turn of calico bandage is applied, or an oval piece of flannel with tapes sewn to its smaller ends.

2. A *protective* bandage is applied to the unaffected eye in unilateral blennorrhœa or diphtheria of the conjunctiva.

(*a*) Pads of cotton-wool are applied to the closed lids so as to fill up the spaces between the orbital margins. These are then made fast with strips of adhesive plaster, or a round piece of linen smeared with soap plaster. These should reach on all sides 1 to 2 cm. beyond the orbital margins, and a number of fine snips should be made in their edges in order that they may be better applied to the skin. Collodion flexile should be freely applied to the borders. The bandage should be removed every day, in order to inspect the eye. If there be a little conjunctival redness (this is unavoidable after the prolonged use of the bandages) we apply (*b*) a watch-glass of appropriate size to the orbital aperture (the eye remaining open) and secure it all round with little strips of plaster or zinc-gelatine (Unna's paste), the occlusion being

made more complete by collodion. The sharp edge of the watch-glass should be guarded by strips of plaster or padded with cotton-wool.*

A protective bandage is also used after an operation on the eyeball. Fuchs's wire mesh-work, which may be moulded by bending its edges to lie closely on all sides, may be applied above the dressings, or (if the patient's face is not hairy) a hollow aluminium or zinc shield may be fastened to the forehead and cheek with strips of plaster.

Moist Application

(in wounds, etc.). Gauze compresses dipped in diluted (1 : 3—10) Burow's solution † are laid upon the eye, covered with some waterproof substance and fixed with a few turns of a bandage.

Pressure Bandages

The orbital opening is padded up to and above the level of the brow and cheek with cotton-wool or white gauze, and this is fixed with adhesive plaster (the eye must be protected against the entrance of fibres of the cotton-wool by a layer of linen or gauze, *e.g.* Gamgee tissue). This pad is then gently pressed against the eye by means of a calico bandage. Care must be taken that it really lies upon the globe and not upon the orbital margins or bridge of the nose.

Hot Compresses

In the first place these must not be too heavy (a few layers of linen or gauze); in the second place, the temperature of the fluid in which they are immersed (water, Burow's solution 1 : 5—10, sublimate solution 1 in 4000) should be the highest which the patient can bear without pain; in the third place, the temperature should be as constant as possible, and therefore they must be renewed very often. The applications should be made while the patient is lying down.

* A small piece of tubing should be inserted, so that the space beneath the watch-glass may communicate with the outer air; otherwise the glass becomes hazy. The watch-glass is preferably sewn into a piece of macintosh (Bullers's Shield).—Trs.

† Burow's solution is a 7 to 8 per cent. solution of aluminium subacetate.—Trs.

THE EYELIDS

Ablepharon. Absence of the lids, a congenital deformity, the subjects of which do not usually live.

Abscess of the Lid. Commonest cause, trauma; less often periostitis or caries of the orbital margin (these latter are often determined by an injury), or erysipelas.

Abscess of the lids is distinguished from inflammatory œdema or erysipelas by the fact that a localised spot is present, where at first resistance and tenderness are greater than elsewhere, while later fluctuation occurs. At this place also the skin is more stretched and shiny, and in the later stages the pus is seen through it.

Treatment. In the earlier stages suppuration should be hastened by hot applications. When fluctuation is detected, a deep and free incision should be made as early as possible after thorough disinfection of the skin with soap, sublimate solution, and ether (the lids being closed, so that none of the ether may run into the conjunctival sac). The abscess is opened in a horizontal direction with a pointed bistoury, the cutting edge of which is turned forwards (*i.e.*, away from the globe), and this should reach the deepest part of the fluctuating spot, so that no pus may be retained. Pads of iodoform or airol gauze, or of wool moistened in 1 to 2 per cent. aluminium subacetate solution, are now applied as long as any inflammatory symptoms remain. Dry antiseptic dressings and an occlusive bandage are used until the abscess cavity has completely granulated up, and during this time drainage must be employed.

Ankyloblepharon is a more or less complete (*A. partiale, totale*) adhesion of the margins of the two lids.

(*a*) *Congenital.* Occurs mostly in the form of one or more thread-like strands (*A. filiforme adnatum*) near the canthi

(especially the outer). They may be divided with a snip of the scissors, and re-formation is not to be feared.

(*b*) *Acquired.* May extend over the whole length of the lid margin, with or without symblepharon. It occurs after burns, the action of caustics, or ulcers which occupy corresponding points on the two lid margins. Lastly, ankyloblepharon is intentionally produced by operation to lessen cicatricial contraction after gangrene of the lid (*q.v.*).

The *treatment* consists in severing the adhesion by operation. Only when it is extensive or lies in the neighbourhood of the canthi need the wound be covered with conjunctiva to prevent the adhesion from forming again.

Anthrax is a phlegmonous inflammation, often leading to gangrene of the lids, caused by infection with the anthrax bacillus (in those who have to deal with infected cattle or their hides). It always leaves the free borders of the lids intact.

The *treatment* consists in antiseptic compresses (1 to 2 per cent. aluminium subacetate, 1 in 500 sublimate), in the opening and plugging of any abscesses, and, where gangrene is present, in a temporary sewing together of the lids to prevent subsequent cicatricial ectropion. This is performed as follows: The eye is cocainised, and a horn spatula is then introduced into the conjunctival sac beneath the lid in order to protect the globe and to give a firm surface to cut upon. The lid margins are then partially refreshed, and sewn together with silk stitches.

After the separation of sloughs, a blepharoplastic operation may be undertaken to repair losses of substance in the skin of the lid.

Blepharitis, or inflammation of the lid margins, occurs in two forms:

(*a*) *Bl. squamosa.* Numerous white scales lie among the lashes, and on the removal of these the underlying skin is found to be reddened. The cilia easily fall out, but grow again, because the hair follicles are not diseased. In many cases the lid margin is covered with honey yellow, transparent, more or less fatty crusts (*Bl. oleosa*), which represent the

abundant inspissated secretion of the sebaceous glands, and are easily removed.

(*b*) In *Bl. ulcerosa* the lid margins are also covered with scales and crusts, but these are often mingled with blood and adhere more firmly to the underlying skin; when they are removed the lid margin shows ulceration of varying extent, and follicular abscesses around some of the cilia. This form is also often complicated with rhagades at the outer canthus, which are very painful and are constantly liable to be torn open, if the lids are somewhat roughly drawn apart, so that healing is hindered.

In consequence of the deeper situation and more suppurative character of the inflammation, *Bl. ulcerosa* is apt to be followed by various permanent sequelæ, of which the chief are:

1. Chronic conjunctivitis.
2. Permanent loss of the cilia in the affected area. When this is total it is named *madarosis*.
3. Thickening of the lid margin: *Tylosis*.
4. *Trichiasis*, the cilia becoming directed towards the eyeball by cicatricial contraction.
5. *Eversion* of the lid margin in consequence of scar formation in the skin. In its higher grade this constitutes *Ectropion*.

The above-mentioned sequelæ in their turn aggravate the initial disease, the blepharitis, so that a circulus vitiosus is set up, a speedy and complete cure of which is therefore highly desirable.

Ætiology. 1. Constitutional: anæmia, tuberculosis, scrofula, especially in children and adolescents; in many families it is inherited.

2. External injurious agencies: bad air, heat, dust, late hours, smoke, eye-strain (in hypermetropia and astigmatism), wind (in coachmen and peasants), prominence of the eyes (so that there is insufficient protection against the outer air).

3. Local causes: conjunctivitis chronica, phlyctenulosa, trachomatosa, lacrymation from conjunctival disease or from defective drainage of the tears. *The lacrymal passages must*

therefore be examined with especial care in all cases of unilateral blepharitis. Pressure should be made over the lacrymal sac and the regurgitation of any secretion (watery, mucous, mucopurulent, etc.) from the puncta noted. If there is regurgitation the lower canaliculus should be dilated with the conical sound and a probe passed down the nasal duct. Besides the ordinary pyogenic microbes the acarus folliculorum can be demonstrated in a considerable number of cases—especially in *Bl. ulcerosa*; but this *Bl. acarica* does not present any typical clinical picture.

Treatment. A minute inspection of the lid margin is first to be made, after having softened the crust and scales with vaseline, and wiped them away with a pledget of cotton wool moistened with lukewarm water.

1. If this is normal except for reddening (*Bl. squamosa*), treatment with ointment is indicated. Before going to bed the patient should rub well into the margins of the closed lids a piece of the ointment chosen (*vide infra*) about the size of a pea. A thin layer of ointment should be left upon the skin of the lid margin. In the case of patients who sleep uneasily, or unruly children who might wipe away the ointment, it is better to lay upon the closed lids a piece of linen somewhat larger than the palpebral fissure, smeared rather thickly with the ointment and to secure this lightly. In the morning the ointment, together with the discharge, should be carefully removed with a soft piece of linen or cotton wool, moistened if necessary with lukewarm water, until the bases of the eyelashes are quite clean. The lid margin should now be once more smeared with ointment, for which purpose if the disease be slight a pure, neutral vaseline may be used (that known as "Gloria" or Vasel. salvo-petrolia). This is with the object of keeping the skin of the lid margin supple and soft so that scales may not form, and also to provide a protective coating from atmospheric impurities. This cleansing and re-application of ointment may be repeated once or twice daily, especially if the patient's employment exposes him to much dust or smoke.

The best basis for the ointment is neutral vaseline ("Gloria"

vaseline, or vasel. puriss. Americ. salvo petrolia), or vasogen, or a mixture of vaseline and lanolin *āā*. To one of these may be added in slight cases 3 per cent. acid boric ; in cases with much crust-formation and hyperæmia of the lid margins 1 to 3 per cent. hydrarg. ammoniat. ; or 1 per cent acid. salicyl., 2·5 to 5 per cent. ichthyol, ½ to 2 per cent. resorcin. Swelling of the lid margins sometimes occurs after the application of the ointment, but soon ceases, as does also the itching which is occasionally felt, especially after the use of the salicylate ointment. Cases in which hypersecretion is quite slight so that actual crusts are not formed, but little scattered scales lying between the cilia on the slightly reddened edge of the lid, give good results when treated with a neutral soap (rubbed into the closed lids in the morning and shortly afterwards washed off again), or with tincture of benzoin (an emulsion of a few drops in a little water applied several times to the roots of the eyelashes with a camel's hair brush or piece of cotton wool. Painting with Ol. fagi (or rusci) and Ol. olivæ *āā*, or with Pix liquid. and Spir. vini *āā* is also indicated in many cases.

Treatment should be carried on long after the blepharitis appears to be healed, the lid margins may be lightly smeared with a non-stimulating ointment (vaseline alone or 3 per cent. boracic or 1 per cent. white precipitate ointment).

2. In *Bl. ulcerosa*, after carefully cleansing the lid margins, the ulcerated areas should be cautiously painted with 10 to 20 per cent. silver nitrate or 1 per cent. picric acid, or touched with the silver stick. Special care must be taken that none of these strong applications enter the conjunctival sac : the cauterised spots should be irrigated with salt solution, so as to precipitate the excess of silver nitrate. The lids' margins are then covered with one of the ointments mentioned above. The eschars caused by the cauterisation are not to be forcibly removed, but healing under the scab is rather to be aimed at. If follicular abscesses are present they should be opened by epilation of the offending lashes, the spots gently touched with the point of the silver stick, and then covered with ointment. Loose cilia are to be removed. If there be much swelling and

diffuse infiltration of the lid margin, compresses of lotio plumbi or 1 to 2 per cent. aluminium subacetate are indicated.

If there are no recent ulcers left, the cicatrised spots should be treated with ointments, which are continued until long after scarring is complete.

In *Bl. acarica* an ointment of Bals. Peruvian. 2·0, Vaseline 6·0, may be recommended.

Simultaneous with the local treatment the exciting cause of the blepharitis must be attacked. Errors of refraction must be corrected with suitable glasses, chronic conjunctivitis, diseases of the lacrymal passages, and lagophthalmos must be treated, and external injurious agencies avoided as far as possible. In constitutional diseases general tonic treatment must be adopted. The sequelæ of *Bl. ulcerosa* must receive attention, especially eversion of the lower punctum, by slitting up the canaliculus (*q.v.*), and ectropion of the lower lid, generally by operation (*q.v.*). 1 to 2 per cent. aluminium subacetate, zinc ointment, or a tar preparation (*e.g.*, ichthyol), is to be used in eczema in the lids according to the acuteness (see Eczema). Trichiasis requires operation. Treatment is ineffectual in madarosis and tylosis.

Blepharochalasis (Fuchs). A baggy enlargement of the upper lid with thinning of the skin, caused by recurrent neurotic œdema, and often accompanied by innumerable fine creases. The atrophy and wrinkling of the skin, and the absence of any fluid removable by pressure, distinguish the condition from œdema.

The *treatment* is operative, and only undertaken for cosmetic effect. A horizontally oval piece of the superfluous skin is excised; the edges are sewn together, a little of the tarsus being included in order to prevent the skin from drooping again.

Blepharophimosis. In subjects with lacrymation and blepharospasm of long duration, and, therefore, especially in chronic conjunctivitis, a vertical fold of skin becomes drawn over the outer canthus, in consequence of the horizontal

contraction of the skin of the lid, thus simulating a shortening of the palpebral fissure as opposed to the true shortening of ankyloblepharon.

The *treatment* must be directed against the primary disease, the chronic conjunctivitis, or a canthoplastic operation for widening the palpebral fissure may be undertaken.

Blepharoplastic operations have for their object the artificial restoration of part or the whole of the lid, lost as the result of previous injuries, burns, gangrene, lupus, scrofula, removal of tumours, etc. This can be accomplished by various methods, the exact description of which would exceed the limits of the present work ; hence, merely the guiding principles will be mentioned here.

A pedunculated flap from the brow or temple may be used to replace the lost skin, or a graft taken from the trunk or the extremities. In the first method the subcutaneous tissue and fat (if not excessive) must be retained in order to secure proper nutrition. The grafts, on the other hand, consist either of the epidermis and tops of the papillæ alone, or of the entire cutis, or lastly, only of the superficial layers of the latter (Thiersch graft). The grafts in the first and second cases are shaved off with a sharp scalpel by light sawing movements, the knife being held at a very acute angle to the surface, any particles of adherent subcutaneous fat being afterwards carefully removed. In the third case a long flat straight knife is used with moderate pressure, being held parallel to the surface.

In cicatricial ectropion with retention of the lid margin, the commonest indication for blepharoplastic operation, the thick, resistant scars must first be excised, then all deep cicatricial strands cut through, so that finally the normal part of the lid becomes freely movable, and can be drawn far over the other lid. This is necessary, because the implanted graft must be at least a third larger than the defect—a pedunculated flap may be somewhat smaller—to allow for subsequent shrinking. The freed lid is pulled up over its fellow and fixed with stitches to the cheek or the forehead as the case may be, the raw surface

being covered by one of the methods already mentioned. A layer of iodoform or boracic ointment is then applied, and upon this a layer of gold-beater's skin or guttapercha tissue. All inequalities are filled in with cotton wool or gauze, and finally a calico and starch bandage is applied. In the absence of pain or fever this need only be removed on the third to fifth day. If the graft has then a rosy colour it is a sign that its nutrition is good, and it may be expected to adhere.

The loss of substance caused by forming the flap is reduced as much as possible by stitches after undermining the edges; it is then dressed antiseptically. Thiersch grafts, and those involving only epidermis and papillæ, leave a surface which heals by over-growth with epithelium under a protective layer of ointment, no stitches being necessary.

The methods for restoring the whole lid or a part including the border are much more complicated, and require greater ingenuity in the operator. Naturally only pedunculated flaps from the neighbourhood can be used, the inner surface of which should be covered with conjunctiva if possible. Recently pieces excised from the cartilage of the ear have been employed to restore the tarsus. The soft skin covering the posterior surface of the auricle is placed in the situation of the conjunctiva towards the globe, whilst the anterior cartilaginous surface is covered with a pedunculated skin flap.

Blepharospasm = spasm of the orbicularis oculi.

(*a*) *Bl. symptomaticus* is an accompaniment of all irritative conditions of the eye, but is not always proportional to the severity of the disease. It is especially pronounced in phlyctenular conjunctivitis; in children after conjunctivitis it is often only a bad habit. It is said to occur reflexly in disturbances of the digestion and menstruation.

Treatment. Removal of the cause—foreign bodies, trichiasis, errors of refraction, especially hypermetropia and astigmatism, conjunctivitis, blepharitis, etc. The blepharospasm which occurs in nervous and anæmic individuals, especially in childhood, disappears usually spontaneously, or after the application of a bandage for a few days.

(*b*) *Bl. essentialis* in normal eyes. Points can often be found at the sites of exit of the branches of the first and second divisions of the trigeminal, in the nose, throat, or mouth, compression of which causes the blepharospasm to disappear immediately.

1. *Bl. hystericus.* The eyes close suddenly and remain closed. It ceases spontaneously, or on application of electricity —constant current of 1 to 2·5 milliampères for 3 to 6 minutes. The action of the anode is soothing, that of the kathode stimulating.

2. *Bl. senilis* is a tonic or clonic spasm (nictitatio), often accompanying tic convulsif ; it is very resistant to treatment, and may sometimes be incurable. If pressure points are found, they may be subjected to methodical pressure, otherwise one may try the constant current, 1 per cent. morphia, or 1 per cent. eucain injections at the sites of exit of the branches of the trigeminal, or in the worst cases subcutaneous section of the affected branch ; even this, however, is not always followed by relief.

Chalazion, or **Tarsal Cyst.**

Treatment. Small hard chalazia require no treatment, or at most absorption may be attempted by massage, which, however, will only succeed in the rarest cases. Larger chalazia, whose contents are always partly softened, can be removed by incision and scraping. The operation can be rendered quite painless if a 3 per cent. solution of cocain be injected into the chalazion after cocainising the conjunctiva.* The lid is everted and fixed between the finger and thumb, or steadied by pressure towards the orbital margin. The chalazion now bulges forwards, and is incised with a sharp bistoury, the back of which is towards the globe, while its point is directed towards the upper or lower orbital margin as the case may be. The fluid and mucoid portions of the contents now well out, and the remainder is scraped out with a sharp spoon. In large chalazia a portion of the conjunctival wall

* Crystals of solid cocain may also be applied after previous cocainsation ; too much should not be used, otherwise symptoms of poisoning may ensue.—Trs.

may be excised with advantage. It is necessary to evacuate the entire contents down to the connective tissue capsule, as otherwise there is almost certain to be recurrence. After evacuation the cavity fills with blood, but this quickly disappears owing to shrinking of the capsule; the process may be hastened by gentle massage. A bandage is unnecessary after the operation, as the wound is not exposed, but the conjunctival sac should be frequently washed out with 3 per cent. boracic acid or potassium permanganate solution. In the presence of severe conjunctivitis or corneal ulcers, the opening of the chalazion should be postponed until normal conditions are restored.

Suppurating chalazia are also opened by incision from the conjunctival surface, or through the skin if they are pointing in that direction. The contents need not be scraped out in this case, but if the cavity is large it should be plugged antiseptically, or cauterised with the silver stick. In this case a bandage is applied, or moist compresses if the inflammation is severe.

Chromhidrosis. The occurrence on the lids of bluish spots of coloured sweat, which can be easily removed with lint dipped in oil, but soon recur. It is a rare affection, seen mostly in women; a large number of cases are probably due to deception and demand no treatment.

Coloboma of the Lid. This may be (1) rarely a *congenital* abnormality, often accompanied by dermoid of the cornea: in these cases a delicate membrane may stretch between the limbs of the coloboma and adhere to the globe; (2) *acquired*, by traumatism—lacerated or incised wound—and is often complicated by injury of the globe.

Treatment is operative, and consists in refreshing the edges of the coloboma and suturing them together. This should be begun at the free margin of the lid, and demands an exact adaptation of the edges of the wound. The stitches must be entered at exactly equal distances from the lid margin, so as to preserve the normal straight contour. If the edges of the wound, especially after laceration, are crushed or soiled, antiseptics are first used—aluminium acetate (2·5 per cent.),

iodoform ointment (3 to 10 per cent.), airol paste, etc.—and the coloboma is sutured after thorough cleansing.

Distichiasis is a rare congenital abnormality in which two parallel rows of cilia are present, the posterior of which is directed towards the cornea.

Treatment. Operative (cf. Trichiasis).

Ecchymosis. Cold compresses of water, lotio plumbi, or 1 per cent. aluminium subacetate.

Ectropion. *Eversion* is the least degree of this affection; it only occurs in the lower lid, the inner border of which falls away from the globe and is no longer closely applied to it. It commences usually at the nasal side, so that the lower punctum becomes everted and epiphora results. This again leads to blepharitis, eczema, shortening of the skin of the lid, and so to aggravation of the eversion until it becomes ectropion.

Sequelæ of ectropion: hypertrophy and cornification of the exposed conjunctiva, lagophthalmos with its results, eczema and blepharitis.

In slight eversion it is often sufficient to forbid the patient to wipe away the tears in a downward direction since this pulls the inner part of the lower lid with the punctum more away from the globe. A supporting bandage is applied, which keeps the lid pressed against the eye. In more pronounced cases, in order to restore proper drainage of the tears, the canaliculus should be slit up with a Weber's knife, the punctum having been first dilated with a conical sound (see Blennorrhœa of the Lacrymal Sac). In the next few days the wound edges should be frequently separated, otherwise they will heal together.

Ectropion spasticum occurs chiefly in the upper lid; it is caused by spasm of the orbicularis when the skin of the lid is tense and elastic—*e.g.*, in young patients, especially children with phlyctenular conjunctivitis, and when the conjunctiva is thickened and swollen, as in trachoma and blennorrhœa.

Snellen's sutures are indicated. A thick silk suture is armed with long curved needles at each end; these are thrust through the highest part of the ectropionised conjunctiva

about 1 cm. apart, pushed up under the skin of the lid as far as the eyebrow, and there brought out. After two or three such threads have been inserted, they are tied over a piece of iodoform gauze, and left for four or five days. If suppuration occurs along the course of the stitches, they must be removed earlier.

Thickening of the lid in consequence of venous stasis gradually disappears under daily oft-repeated massage.

If the ectropion is not cured in this manner the palpebral fissure may be shortened by an external tarsorrhaphy.

Ectropion mechanicum is due to separation of the lids by enlargement of the globe or orbital contents, and usually affects the two lids of one side. The primary cause must be attacked—abscission of the cornea or excision of the eye, extirpation of orbital tumour, horizontal shortening of the palpebral fissure in Graves's disease, by the operations of Szymanowski or Dimmer, or the tarsorrhaphy of Fuchs.

Ectropion paralyticum results from paralysis of the orbicularis oculi, and affects only the lower lid, causing lagophthalmos. It may be treated by bandage, the constant current (1 to 2·5 milliampères, 3 to 6 minutes, anode or kathode), or in its higher degrees by operation.

Ectropion cicatriceum or cicatricial shortening of the skin of the lid, can only be cured by a plastic operation (see Blepharoplastic Operations).

In traumatic colobomata of the lower lid ectropion is produced by weakening of the orbicularis, which, however, can be easily cured by suturing the coloboma.

Eczema of the lid usually presents itself as a moist eczema in scrofulous anæmic children, and is therefore very often combined with phlyctenular conjunctivitis. It also occurs in the subjects of epiphora following inflammation of the conjunctiva or lacrymal sac, ectropion, or lagophthalmos, and is then due to maceration of the skin of the lower lid. Finally, it not infrequently occurs as the result of prolonged bandaging after operations on the globe, quite apart from the artificial eczema which may be produced by iodoform, or salicylic plaster containing camphor, used to secure dressings: adhesive plasters

should, therefore, never contain camphor. There is also an eczema characterised by a rough scaly condition of the somewhat red and swollen skin, and associated with much itching and burning. It occurs after the use of powders containing aromatic oils, or during great heat; in many cases the cause is not clear. Acute eczemas with œdematous swelling and redness of the skin are not so common.

Treatment. The above-mentioned dry, slightly scaly forms of eczema of the lids are the most rapidly and easily cured. Repeated applications of ung. zinci oxidi, or ung. zinci Wilsoni alone or with equal parts of ung. diachylon or Lassar's paste (zinci oxidi, talc. Venet. āā 1·0, vasel. flav. 2·0) is usually completely successful. In other cases the following may be recommended:

℞ Acidi salicyl. . . . . 0·5
Lanolini . . . . . 60·0
Vaselini flav. . . . . 30·0
With or without the addition of—
Tinc. benzoini . . . . . 4·0

℞ Zinci oxidi . . . . . 50·0
Amyli pur.
Talc. Venet. . . . . āā 25·0
Vaselini flav. . . . . 100·0

The ointments are applied in the evening, and carefully removed with vaseline in the morning, if the patient is unable to keep his room. The skin is then lightly powdered; no water must be allowed near the affected part.

Acute eczema in children and adults is to be treated antiphlogistically, best with aluminium acetate compresses (1 to 2 per cent.); after the acute stage is over zinc ointments are used: ung. zinci oxidi, ung. Wilsoni, with or without ung. diachylon āā, Lassar's paste. The following is also useful:

℞ Acidi boracici . . . . . 5·0
Glycerini . . . . q.s. ad solv.
Ceræ alb.
Paraffini . . . . . āā 20·0
Ol. oliv. . . . q.s. ut f. ung. molle.

Special care is necessary in treating the common impetiginous eczema of children. In this case it is above all things essential to gently remove the scabs and crusts; this is effected most easily and with least pain after previously softening them with oil, cod liver oil, vaseline, or 3 per cent. sod. bicarb. solution. Immediately after the removal of the crusts the raw spots are to be painted with 3 to 10 per cent. argent. nit. three or four times, drying the spots by dabbing—not wiping—with cotton wool between each application. The greatest care must be taken that the caustic fluid does not come into contact with the conjunctiva or cornea. Ointment is applied over the eschar—3 per cent. boracic ointment, 1 per cent. ung. hydrarg. amm., ung. zinci oxidi, ung. diachylon Hebra, boracic paraffin ointment (*vide supra*), or

℞ Hydrarg. ammon.
Bismuthi subnit. . . . . āā 4·0
Ung. simpl. . . . . 60·0

A good application is 10 per cent. zinc vaseline with the addition of 5 per cent. ichthyol. It is especially useful in children, in whom eczema of the lids most frequently occurs, and is best used thus: A linen mask is cut out to correspond with the affected area, holes being made for the eyes, and if necessary for the nose and mouth. The ointment is smeared upon one side of the mask to the thickness of the back of a knife; this is then applied and changed every day.

The treatment with silver nitrate should at first be repeated every two or three days. If the formation of scabs has ceased, and the surface has skinned over, boracic ointment or Lassar's zinc paste should still be used for a short time until healing is complete.

Instead of painting with silver solution an ointment of silver nitrate (2 to 3 per cent.) or protargol (6 to 10 per cent.) may be employed. At the same time lice are looked for in the hair, and if present, thoroughly removed—smearing with petroleum, washing after a few hours with dilute acetic acid, and careful combing of the hair.

Elephantiasis. The treatment consists in the removal of the superfluous skin.

Emphysema is the entrance of air into the loose subcutaneous tissue of the lid from the neighbouring sinuses. It is usually traumatic from laceration of the thin bony walls of the orbit, generally the lamina papyracea of the ethmoid; less commonly it is spontaneous, especially in glass-blowers and trumpeters. The lids are pale and swollen, the swelling disappearing on pressure, with a crackling sound and feeling of crepitation. On straining the swelling reappears. Emphysema of the lids is often combined with emphysema of the orbit, exophthalmos and ecchymosis (cf. Diseases of the Orbit).

Treatment. Avoidance of forced expiration—coughing, sneezing, blowing the nose, straining at stool, etc.—and a pressure bandage for a few days, renewed once or oftener daily.

Entropion, rolling in of the lid margin, occurs almost exclusively in the lower lid.

(*a*) *Entropion spasticum* results from contraction of the orbicularis when the skin of the lid is slack and inelastic—in old people. Its occurrence is favoured by absence, smallness, or deep position of the globe—*Entropion organicum.*

Ætiology. Blepharospasmus senilis: prolonged use of a bandage in old people. Blepharophimosis.

(*b*) *Entropion cicatriceum.* From cicatricial contraction of the conjunctiva—trachoma, diphtheria, burns, etc.

Treatment. Entropion spasticum. The bandage should be left off, or if this is impossible (*e.g.*, after operations on the globe), a roll of plaster is laid upon the lower lid near the orbital margin and pressed backwards by the bandage, or a piece of adhesive plaster is fixed to the lower lid to pull it downwards. If these measures fail, more effectual operative treatment must be adopted—the excision of a horizontal or triangular (with the apex downwards) fold of skin. Somewhat more complicated is the operation of Hotz and its modifications, which consist essentially in the excision of a portion of the orbicularis near the free edge of the lid and in fixation of the skin to the tarsus.

Entropion cicatriceum is also treated by operation, as above.

Entropion organicum requires the wearing of a glass eye.

Epicanthus. *Treatment* is operative—excision from the bridge of the nose of an elliptical fold of skin, with the long axis vertical, or of the fold itself.

Erysipelas. *Treatment.* Compresses of hydrarg. perchlor. (1 in 1000), or 1 to 2 per cent. aluminium subacetate, or absolute alcohol. Attempt to limit the spread by injection of 0·1 per cent. hydrarg. perchlor. Lid and orbital abcesses are treated by deep incisions and drainage; gangrene by sewing the lids together to prevent cicatricial ectropion and lagophthalmos (cf. Anthrax). After the throwing off of the slough and cicatrisation, a blepharoplastic operation is performed, the artificial suturing of the lids being released. If the scarring is very great, the lids must first be opened, and then an extensive blepharoplastic operation undertaken, with grafting if necessary.

Furuncle. *Treatment.* First, warm antiseptic compresses; later, when fluctuation is present, incision, drainage, and antiseptic dressing.

Gangrene of the Lids. (*a*) *Endogenous* or metastatic in typhus, measles, scarlatina, influenza, pyæmia, sepsis, diabetes.

(*b*) *Ectogenous*, caused by local affections, the chief of which are erysipelas, anthrax, variola, eczema impetiginosum.

Treatment. Antiseptic compresses—carbolic acid (3 per cent.), hydrarg. perchlor. (1 in 1000), 1 to 2 per cent. aluminium subacetate. When the process is extensive the palpebral fissure should be temporarily sewn together, after partially refreshing the lid margins, in order to prevent over-contraction and its consequences—ectropion, lagophthalmos; when cicatrisation is quite complete the loss of substance in the skin may be restored by a plastic operation. The scar is to be massaged for a long period, in order to make it soft and elastic. When the gangrene is less extensive, the palpebral fissure can be perfectly closed after removing the stitches, so that further interference is superfluous (cf. Blepharoplastic Operations).

Herpes zoster, or zona ophthalmica, commences with trigeminal neuralgia and fever; groups of vesicles then appear

on the reddened and swollen skin in the distribution of the first or second divisions of the fifth nerve, or both. The vesicles burst and become ulcers, which, by their grouping and sharp limitation to the distribution of the affected branches, leave characteristic scars throughout life. Involvement of the cornea is a serious complication (cf. Keratitis Vesiculosa).

Treatment. Local: the affected part is dusted with powder —simple rice powder, or zinc. oxid., and talc. Venet. āā, or—

℞ Acidi boracici . . . . . 1·0–5·0
sive Acidi salicyl. . . . . 0·5–2·5
sive Thioli sicc. . . . . 2·5–10·0
Zinci oxidi
sive Bismuthi subnit.
Talc. Venet. . . . . āā 25·0

It may also be bandaged. In this manner the drying up of the blebs is prevented, or if they have already burst the exposed ulcers are protected.

The treatment of corneal complications is conducted according to general principles (see Cornea).

General: sodium salicylate in large doses is to be recommended for the disease of the nerve and Gasserian ganglion, which is the cause of the mischief. The neuralgia, pain, and insomnia may be combated by antipyrin (0·5–1·0; gr. 8–15), phenacetin (0·5–1·0; gr. 8–15), pyramidon (0·25–0·5; gr. 4–8), aspirin (3·0–6·0; dr. 1–1½), or even morphia injections. Schleich's injections* (2 to 3 drops) at the points of exit of the nerves may also be used under certain circumstances.

Hordeolum externum. Inflammation of Zeiss's sebaceous glands at the roots of the lashes. The inflammatory symptoms may be so severe that the whole lid and even the conjunctiva are œdematous. By cautious palpation a localised spot of resistance is found, which is especially tender. Here a yellow

* Schleich's infiltration anæsthesia is produced by injection into the *papillary* layer of the cutis; one spot having been treated, a series of injections are made from it along the line of incision. A sterile 5 cc. syringe is used with the following fluid: cocain hydrochlor. 0·1, morph. hydrochlor. 0·02, sod. chlor. 0·2, aq. steril. ad 100. (Schleich, *Schmerzlose Operationen*, Berlin, 1897.)—Trs.

prominence gradually becomes visible—an abscess, which bursts either along a cilium or close above the root.

A diffuse inflammation of Zeiss's glands constitutes Blepharitis ulcerosa (*q.v.*).

N.B. When the lids, and especially the conjunctiva, are highly œdematous, swollen and red, a severe ophthalmia may be simulated, or when the inner part of the lid is involved, a dacryocystitis, periostitis, etc. To avoid a wrong diagnosis, the margin of the lid should be lightly palpated, when a specially tender, resistant spot will be found. Further, there is little mucous or purulent discharge in the conjunctival sac, the cornea and iris are normal in appearance, there is no tenderness to pressure over the lacrymal sac or orbital margin, nor any circumscribed thickening here. If an abscess has already developed, a mistake is impossible. If the hordeolum is first seen after it has already burst, the neighbouring cilia are matted together with pus, on the removal of which the affected spot becomes visible.

Treatment. First, hastening of suppuration by warm compresses with water, or 1 per cent. aluminium subacetate solution. If there is already deep-seated suppuration the abscess should be opened. Sometimes the pus can be evacuated by epilation of the affected cilia ; otherwise a puncture is made or a short incision in a direction away from the lid margin, the globe being protected if necessary with a Jaeger's spatula. Healing speedily follows ; to prevent recurrence, any blepharitis which may be present should be treated.

Hordeolum internum sive Meibomianum resembles hordeolum externum in its course, except that it is often more severe, and the formation and evacuation of the abscess require a longer time, owing to the dense structure of the tarsus. It bursts either along the duct of the gland or through the conjunctiva.

Treatment as for hordeolum externum. The incision should be made from the conjunctival surface after eversion of the lid, and should always be perpendicular to the lid margin, so as to correspond with the direction of the suppurating gland, which shines through as a yellow streak.

Hyperæmia of the Margin of the Lid is a reddening, without any other abnormality, of the lid edges, affecting almost always both lids of one eye, or still more frequently of both eyes. The inconvenience is slight; the sensitiveness of the eye is increased, and slight lacrymation, burning, and itching are present. It is common in young, anæmic, scrofulous people.

Causes. Prolonged weeping, eyestrain — hypermetropia, astigmatism—late hours, bad air, etc., conjunctivitis.

Treatment is of little avail so long as the cause persists. Causal: spectacles, avoidance of injurious influences; general régime. Local: washing of the lid margins with a neutral soap, dabbing with an emulsion of tinc. benzoini, or

℞	Acidi boracici	3·0–5·0
	sive Acidi salicyl.	1·0–2·0
	sive Resorcini	1·0–2·0
	Spiritus vini (60–80 per cent.) . .	100·0

Smearing with 1 per cent. salicylic acid vaseline, 3 per cent. boracic acid vaseline, 1 to 5 per cent. resorcin ointment, 2·5 to 5·0 per cent. ichthyol ointment. Compresses of lotio plumbi are cooling, astringent, and antiphlogistic.

Infarcts of the Meibomian Glands only require treatment when they become hard and calcified, and penetrating the conjunctiva, mechanically injure the globe—*lithiasis palpebralis sive conjunctivæ.* In this case they are picked out through an incision with a fine-pointed bistoury or discission needle.

Lagophthalmos. *Ætiology.* Paralysis of the orbicularis (*q.v.*).

Shortening of the lids, usually after burns and ulcers (lupus); congenital shortening is seldom so great as to be injurious.

Ectropion.

Death agony, loss of consciousness (reflex blinking is abolished, owing to diminished sensitiveness of the cornea).

Enlargement of the eye and orbital contents.

Graves's disease.

Treatment. Symptomatic. Occlusive bandage: the lids are

artificially brought together by strips of court plaster placed perpendicular to the lid margins, and then covered with cotton wool during the night, or in the higher degrees continuously.

Operative : tarsorrhaphy, Szymanowski's method.

Œdema of the Lids is merely a symptom which, on account of the local anatomical conditions, the looseness and great vascularity of the tissues, accompanies not only all inflammatory processes of the lids and their neighbourhood (œdema callidum) but also results from simple venous congestion or altered conditions of the blood (œdema frigidum). The swelling makes the necessary examination of the eyeball more difficult, especially since spasm of the orbicularis is often present as well.

Until the œdema reaches its highest degree the skin of the lids is tense, smooth and shining, while during retrogression it is thrown into fine folds, a circumstance which is of importance in judging of the stage of the process.

Causes and differential diagnosis. It must first be determined whether the œdema is inflammatory or not. The former is characterised by much redness, by heightened temperature, and sometimes by tenderness to pressure. At the same time the preauricular glands may be found enlarged and painful.

A. *Œdema callidum.* I. Situation of the disease in the lids themselves or in the neighbouring skin or bones.

(*a*) *Hordeolum.* The finding of a localised resistant spot, specially tender to palpation, is important in the diagnosis. Later the pus points at this place, either between the cilia (H. externum) or on the conjunctival surface of the lid (H. internum).

Treatment. (Cf. Hordeolum.)

(*b*) *Furuncle, anthrax pustule* : a localised tender, hard spot in the skin of the lid.

Treatment. (See under Furuncle, Anthrax.)

(*c*) *Abscess of the lid* : a resistant, tender infiltrate in the subcutaneous tissues.

Treatment. (Cf. Abscess.)

(*d*) *Periostitis of the orbital margin* : a localised tender spot is found on palpating the orbital edge. By careful comparison

with the other side a thickening will also usually be demonstrated.

Treatment. Ung. hydrarg., moist compresses ; if fluctuation be present, incision.

(*e*) *Erysipelas.* Uniform swelling and redness of the skin which feels thickened and resistant. It is delimited from the surrounding skin by a sharp, somewhat raised, and often zigzag boundary.

Treatment. (Cf. Erysipelas.)

(*f*) *Dacryocystitis.* An area of swelling and infiltration at the inner canthus. On pressure upon the lacrymal sac pus wells from the punctum or passes down into the nose. There is often a history of prolonged epiphora, which is not sufficiently explained by the condition of the conjunctiva.

Treatment. (Cf. Dacryocystitis.)

(*g*) *Trauma.* The wound, or at least ecchymosis, should be visible.

Treatment. Compresses of lead lotion or 1 to 2 per cent. aluminium subacetate solution. If a wound is present, antiseptic dressing.

(*h*) *Insect stings.* The puncture is seen.

Treatment. Aq. plumbi, 1 to 2 per cent. aluminium subacetate.

(*i*) *Vaccinia.* Suppurating ulcers on the lid margin (see under Ulcers).

II. Situation of the disease in the eyeball or its adnexa.

(*a*) Blennorrhœa acuta
Diphtheria conj.
Catarrh. acutus
Conj. phlyctenulosa
} The diagnosis is made on examining the conjunctival sac (see under the separate headings).

(*b*) Iridocyclitis, acute glaucoma. A careful inspection of the eyeball is necessary.

(*c*) Panophthalmitis
Tenonitis
Orbital phlegmon
} Associated with exophthalmos, limitation of movement of the eyeball, and chemosis. (Details of the differential diagnosis will be given under the several headings in the section on diseases of the orbit.)

B. *Œdema frigidum.* The lids are pale, slightly reddened, or sometimes a little bluish ; cold to the touch, and not tender.

1. The result of heart disease or hydræmia (often as an œdema fugax).

Treatment must be directed to the general disease.

2. *Recurrent Neurotic Œdema* occurs most often in women, especially at the menstrual periods. It sets in suddenly often disappears quickly, and is frequently associated with œdema of the lips or extremities, more rarely of the pharynx or larynx.

Treatment. Lead lotion compresses, massage.

3. Œdema of uncertain origin.

Treatment. As in No. 2.

Paralysis of the Orbicularis oculi. A recent paralysis is recognised by incomplete closure of the eye in consequence of the immobility of the lower lid. The only complaint is of epiphora. Later ectropion paralyticum develops and even keratitis e lagophthalmo.

Ætiology. Facial paralysis, most commonly of rheumatic origin ; sometimes traumatic, from fracture of the base or operations in the region of the parotid ; or from otitis media, tumours, syphilis. The lesion is usually in the peripheral course of the nerve ; in facial paralysis of central origin the orbicularis is commonly left intact.

Prognosis. This is best in the rheumatic forms, but some weeks are always required for a cure.

Treatment. Consists in the use of electricity (constant current of 1 to 2·5 milliampères for 3 to 5 minutes), and the application of an occlusive dressing, with some vaseline or boracic ointment at night to protect the cornea from dessication. In incurable cases an operation is performed (Tarsorraphy, etc.).

Photophobia is an accompaniment of all diseases of the eye associated with blepharospasm, especially, therefore, of phlyctenular conjunctivitis. It is also sometimes caused by neuralgia of the first or second division of the trigeminal, particularly in anæmic patients, and occurs in combination with nervous (hysterical) asthenopia.

The *treatment* is to be directed towards the primary cause. Foreign bodies must be looked for in the cornea and beneath the upper lid, and trichiasis treated. In trigeminal neuralgia, when it occurs periodically, quinine (1·0 to 1·5 grm.–gr. 15 to gr. 25) may be taken 3 to 4 hours before the expected attack, or the constant current may be employed (1 to 2·5 milliampères for 3 to 6 minutes, anode on the pressure points), or caffein sodio-salicylate (0·1 to 0·2 grm.–gr. 1 to gr. 3, twice or thrice daily) may be prescribed, or aspirin (0·5 grm.–gr. 8, 3 to 6 powders daily) or tinct. gelsemii sempervir. m. 10 to 15 several times a day.

In neuralgia, in consequence of asthenopia or conjunctivitis :

℞ Ergotæ . . . . . 1·0 (gr. 15)
Quinin. hydrochlor. . . 2·0 (gr. 30)
Ferri sulphat. . . . . 5·0 (gr. 75)
Extr. gentian. . q. s. ut fiant pilulæ 100
S. Two pills three times a day.

(The action of these is sometimes only manifest after two or three weeks.)

Or a subcutaneous injection of 5 to 10 m. of—

℞ Ac. osmic. . . . . 0·05
Aq. destillat. . . . . 10·0

In neuralgia, the result of migraine, hysteria, or neurasthenia—

℞ Menthol valerian. (validol) . . . 5·0
Aq. destill. . . . . 25·0
Syr. aurant. . . . . 30·0
S. Twenty-five drops daily.

Or—

℞ Antipyrin
sive Phenacetin } in doses of 0·5 grm. (gr. 8)
sive Pyramidon

Symptomatic photophobia in phlyctenular conjunctivitis may be combated by dropping upon or between the lids every morning cold 3 per cent. cocain solution three or four times in succession at intervals of a few minutes. The patient may be encouraged to open the eyes by darkening the room to

a moderate extent. Experience has shown that the photophobia often entirely disappears in a few days, if we succeed by the above means in getting rid of it for a short time. It is naturally of the greatest importance to treat at the same time the phlyctenular affection of the conjunctiva with calomel, ung. hydrarg. oxid. flav., etc. (see under Conj. phlyctenulosa). Any blepharitis ulcerosa or rhagades at the outer canthus must also be treated by touching with the silver nitrate stick, 10 per cent. argent. nitrat., or 1 per cent. picric acid solution, for the patient will not open his eyes so long as this involves the tearing apart of these fissures.

Photophobia and blepharospasm, the result of corneal affections—especially of keratitis interstitialis—are often notably improved by the frequent instillation of dionin (10 per cent.) and by the use of the constant current. (Cf. Scleritis.)

In severe blepharospasm, which resists all these remedies, we may proceed to a canthoplastic operation.

Phthiriasis palpebralis, due to body lice, may be mistaken for blepharitis squamosa on superficial examination. Minute inspection reveals the brown nits or even the living parasites among the lashes.

Treatment. Smearing the edges of the closed lid with ung. hydrarg., 5 to 10 per cent. yellow precipitate ointment, or painting with—

℞	Bals. Peruvian	15–25
	Spir. ætheris	50·0

and subsequent washing with soap soon kills the parasites.

To remove the nits :

℞	Acidi acet. dil.	1·0
	Lanolini pur.	6·0
	Vaselini flav.	4·0

this causes the chitinous envelopes to swell, when they can be easily removed with cotton-wool.

Ptosis. 1. *Pt. adiposa.* Great increase in the folds of the upper lid, resulting from slackness of the fasciæ which pass

from the tarsus to the tendon of the levator palpebræ, and falling forwards of orbital fat; it appears as a pale, doughy pouch, which often hangs as low as the free margin of the lid, and affects especially the inner half. In the lower lid it forms a sausage-like protrusion over the bony wall of the orbit.

Treatment. When very large, excision.

2. *Pt. congenita.* Often combined with other congenital anomalies—epicanthus or inability to look upwards.

Treatment. Operative (*vide infra*).

3. *Pt. myopathica.* A primary atrophy of the levator palpebræ, always bilateral, gradually developing, especially in middle-aged women, without known cause.

Treatment. Operative.

4. *Pt. paralytica.* From injury or disease of the levator palpebræ, or its nerve supply. It is therefore an accompaniment of paralysis of the oculomotor nerve. Isolated ptosis is usually cerebral in origin. *Pt. traumatica* is also included here.

Treatment. If the muscle is wounded, an attempt should be made to suture it; otherwise electricity and antisyphilitic treatment, etc.

5. *Pt. sympathica.* Caused by paralysis of the unstriped musculus palpebralis superior, or Müller's muscle. An accompaniment of the so-called "Horner's symptom-complex," due to paralysis of the cervical sympathetic—constriction of the pupil, slight narrowing of the palpebral fissure, and sometimes a little enophthalmos. There are also the symptoms due to vaso-dilatation of the same side of the face. (Cf. Paralysis of the Sympathetic.)

Treatment. Galvanisation of the cervical sympathetic, extirpation of tumours which compress it—thyroid glands, etc. A complete cure is scarcely ever attained, and seldom even an improvement.

Pt. trachomatosa. Slight, caused by the weight of the upper lid in consequence of the gelatinous infiltration of the tarsus and hypertrophy of the conjunctiva, perhaps also by degeneration of the levator.

Treatment. That of the underlying trachoma.

Of the numerous ptosis operations, some (Pagenstacher, Koster) aim at raising the lid by cicatricial bands which are produced by subcutaneous sutures passing through the whole height of the lid, whilst others attempt to fasten the weak or paralysed muscle to the frontalis (Panas, Hess), or rectus superior (Motais). A piece of the levator also may be excised, or its tendon advanced (Eversbusch).

Shortness of the Lids. Congenital, and seldom very great, though increased by consecutive blepharitis and conjunctivitis, and leading to lagophthalmos.

To estimate it, the vertical height of the closed lid, *i.e.*, the distance between the eyebrow and the free edge, is first measured, and then the vertical extent of the skin of the lid, after smoothing out its folds by lightly drawing it down with the thumb and forefinger. If the latter is less than one and a half times the former, the closure of the lids will be imperfect.

Treatment consists in applying a dressing with 3 per cent. boracic ointment, or when blepharitis is present 1 per cent. ung. hydrarg. ammon. overnight. The lid margins are thoroughly cleansed in the morning, blepharitis ulcerosa being suitably treated ; in more pronounced cases the lid is lengthened by a blepharoplastic operation. (Cf. Lagophthalmos.)

Tarsitis. Tertiary or gummatous infiltration of the tarsus, developing gradually and without pain. The lid is much enlarged, the skin tense and red, the tarsus thickened and cartilaginous. Eversion is effected with difficulty, or is impossible. The lashes fall out, and the preauricular gland enlarges ; the course is chronic.

Treatment. Locally, ung. hydrarg. ; general antisyphilitic treatment.

Trichiasis. Faulty direction of the lashes towards the eyeball, total or partial ; they are often distorted, or replaced by downy hairs. The posterior border of the lid is rounded off.

Causes. Trachoma in the cicatricial stage, scarring after blepharitis, diphtheria, burns, operations, etc.

Sequelæ. Photophobia, epiphora, corneal haze, pannus, and diceration.

Treatment. If only a few cilia are affected, electrolysis—anode on the temple, kathode in the form of a fine needle thrust some millimetres along the cilium into the hair follicle, current closed for 1 to 2 minutes. The papilla of the hair is thus destroyed, as is shown by the welling up of a white froth beside the lash, which can then be easily removed with forceps, and does not grow again. If extensive or total, an operation must be performed.

Tumours. A. *Benign.*

1. *Xanthelasma*, or xanthoma.

Treatment. Excision under cocain anæsthesia with subsequent stitching of the wound is best. Electrolysis (2 to 4 milliampères, 3 to 5 minutes, a needle being used as the kathode), can only be employed in the small commencing plaques, since the treatment is tedious, and seldom gives permanent results.

2. *Molluscum contagiosum.* Small, round, sharply circumscribed tumours of white colour and waxy lustre, having upon the summit a depressed spot from which a whitish substance can be squeezed out. They are contagious, and have been attributed to infection with coccidia.

Treatment. Evacuation with a sharp spoon or comedo tube ; the sac should be also removed, and the cavity touched with the silver stick.

3. *Molluscum simplex*, or fibroma molluscum, requires excision.

4. *Warts. Cornu cutaneum.* Excision.

5. *Cysts.* Milia, atheromatous cysts, dermoid cysts, marginal cysts from Moll's glands, cysts in the lower lid in microphthalmos.

Treatment. When necessary excision, with complete removal of the wall, so as to prevent recurrence.

6. *Angioma.* Usually of congenital origin, but growing later ; may involve also the conjunctiva and orbit.

(*a*) *Teleangiectasis*, bright red spots, lying in the skin itself.

(*b*) *Tumor cavernosus*, a bluish swelling under the skin. The individual vessels are palpable and compressible, the supplying arteries dilated and tortuous.

Treatment. On account of the tendency to grow, especially

in the depths of the orbit, it should be removed as early as possible.

(ad *a*) In quite small teleangiectases extirpation with the knife or thermocautery. Or electrolysis, beginning at the edge ; a thick needle is used as the kathode, and is thrust deep into the tumour ; the current is now closed, the anode being applied to the nape of the neck or the forehead, and usually in 1 to 2 minutes thrombosis occurs in the part, with evolution of hydrogen. Numerous applications are required, at each of which several punctures are made. From time to time recurrences are looked for, and they or their vessels of supply are attacked.

(ad *b*) Electrolysis. Excision only in sharply circumscribed, encapsuled tumours ; otherwise it is not to be recommended, on account of the free hæmorrhage, and the lagophthalmos and ectropion which may result from the loss of skin.

B. *Malignant.*

1. *Carcinomata.* (*a*) Epitheliomata.

(*b*) Glandular carcinomata, originating in the sweat or sebaceous glands.

(ad *a*) Especially important are the flat rodent ulcers occurring in the lids, which present themselves as ulcers with hard, raised, everted edges, covered with sebum-like crusts ; they tend to cicatrise on the surface and spread beneath. They must therefore, in all cases, be removed with a rim of skin about 1 cm. broad, and at the same time the preauricular glands should be excised, even when they are not yet enlarged or infiltrated.

2. *Sarcomata* are rare, often pigmented, and occur particularly in the tarsus.

Treatment. Extirpation, if necessary sacrificing the globe, whether it is diseased or not, or exenterating the orbit. The incision must be made in sound skin, about 1 cm. from the disease on all sides. Subsequent plastic operation.

C. *Various rare Tumours.* Lipomata, fibromata, enchondromata, myxomata, lymphomata, plexiform neuromata, adenomata of the sebaceous, Meibomian, or Krause's glands.

These should be removed by operation when growing rapidly, or when inconvenient from their size.

Tylosis. (Cf. Blepharitis.)

Ulcers of the lids occur :

1. *After injuries*—burns, action of caustics, bruises.

2. *Spontaneously*, in scrofula, especially in children, combined with caries of the orbital margin, lupus, syphilis—primary or tertiary—herpes zoster, infection with vaccine, and in rodent ulcer.

Differential Diagnosis. Herpes zoster is strictly unilateral, confined to the distribution of the affected nerve trunk—first or second division of the trigeminal—and arranged in groups. The ulcers result from the bursting of vesicles, and intact vesicles and pustules may be found between them.

Vaccinia occurs most commonly in the nurses of vaccinated children, exceptionally in the children themselves. It is situated on the edge of the lid, and often affects the opposite lid by contact ; it is distinguished from blepharitis ulcerosa by its more suppurative character, by its extension over the roots of the lashes and the conjuctival border, as well as over the external skin, and by the marked œdema of the lid and often also of the conjunctiva.

Chancre, rare in this situation, is characterised by a dense red or livid projection, covered in the middle with scabs ; on removing these a shiny red and moist, or a greyish red, dull depression is seen, or less frequently a gangrenous area.

Lupus and *ulcerating syphilides* are much more difficult to distinguish. In the former the floor granulates, is not covered with pus, and is neither much depressed nor raised ; in the latter the edges of the ulcer are steep and indurated, the floor like wash-leather and punched out, often kidney shaped. Important points of difference are the slow progress of lupus, and the favourable influence, obvious in 8 to 14 days, of antisyphilitic treatment in specific ulcers.

Rodent ulcers have hard, pale edges, extend slowly, and are not influenced by antisyphilitic treatment.

Treatment :

(ad 1) Antiseptic compresses if the inflammatory reaction is

severe, otherwise dressing with boracic ointment or iodoform ointment or airol paste.

℞ Airoli . . . . . 5·0
Lin. exsicc. Pick *
Kaolini . . . . . āā 10·0

(ad 2) Scrofulous and lupous ulcers only heal after destruction of the diseased tissue by scraping and cauterising with the silver stick ; but excision is better, with suturing or transplantation according to the size of the defect. If caries is present under the floor of the ulcer, stitching, etc. must be postponed until the carious process has ceased, and the sequestrum has been thrown off.

Syphilitic ulcers demand general specific treatment with mercury and iodide, and local application of mercurial ointment.

The ulcers due to herpes zoster are dusted with powder and bandaged dry, or with iodoform or boracic ointment, to which sedatives—cocain 1 to 5 per cent., chloral hydrate 2 to 10 per cent. —may be added to ease the pain. If there be much swelling around, compresses may be used of boracic acid 4 per cent., or ichthyol solution 1 to 2 per cent., or the corresponding ointments, or

℞ Bismuthi subnit. . . . . 20·0
Glycerini . . . . . 10·0
Aq. dest. . . . . 500·0

℞ Ichthyol . . . . . 0·2-0·5
Amyli
Zinci oxidi . . . . . āā 10·0
Vasel. flav. . . . . 25·0

Vaccination ulcers heal completely in a few days under an iodoform ointment dressing.

Wounds. Recent clean wounds are sutured, sometimes after paring the edges, and a dressing is applied. Dirty, lacerated wounds, and burns are treated with antiseptic moist dressings or ointments until the necrotic parts are cast off ; when cleansed, they are stitched. (Cf. Coloboma of the Lid.)

* Tragacanth 5·0, glycerine 2·0, alcohol (90%) 10·0, water to 100·0.

THE CONJUNCTIVA

Amyloid Degeneration of the Conjunctiva. Degeneration of the conjunctiva to a thick, yellow, waxy, transparent, brittle mass, very poor in vessels. It commences in the fornix, and spreads chiefly to the tarsus, but to a less extent also to the bulbar conjunctiva and semilunar fold. In advanced cases it projects between the lids and globe, or surrounds the cornea like a new growth. Its course is very chronic, without inflammatory symptoms; it is usually bilateral. It occurs in middle life, and is often associated with trachoma.

Treatment. Excision: the whole mass should not be removed, on account of the partial spontaneous shrinking of the degenerated parts.

Argyrosis conjunctivæ. A bluish, slate grey, or blackish discoloration of the conjunctiva, mostly of the lower fornix, the result of long-continued treatment, especially instillation of silver nitrate or protargol for catarrh, trachoma, etc. It consists in a silver impregnation, chiefly of the elastic fibres of the conjunctiva, and cannot be cured.

Burns. See Injuries.

Caruncle. 1. *Cysts*, if they cause deformity or annoyance by their size, may be removed.

2. *Retraction of the Caruncle* is often observed after tenotomy of the rectus internus, from pulling back of the conjunctiva with the tenotomised muscle. It is of no importance apart from the slight cosmetic defect. Correction is unnecessary, but its occurrence may be avoided by stitching the tenotomy wound.

3. *Encanthis*, *i.e.*, tumours of the caruncle.

(*a*) *Benign Encanthis:* polypi, papillomata, cysts, dermoids.

(*b*) *Malignant Encanthis:* pigmented sarcomata.

Treatment. Operative removal, the incision being made as far as possible from the disease in (*b*).

4. *Inflammation of the Caruncle* is an accompaniment of every severe conjunctivitis, and also occurs as an isolated phenomenon, resulting from local injuries by foreign bodies or mechanical irritation due to partial trichiasis, warts of the lid margin, etc.

Treatment. According to the ætiology: treatment of the conjunctival disease, trichiasis, etc., and removal of foreign bodies.

5. *Nævus of the Caruncle* must always be removed if possible, since it may give rise to malignant sarcomata.

6. *Papilloma of the Caruncle* must be extirpated along with a portion of sound tissue, since it not only has a great tendency to recur, but may develop into a carcinoma, though this is very rare.

Chemosis is a tense, deep red swelling of the conjunctiva bulbi, which either ceases abruptly with a thickened edge at the corneal margin, or overhangs the peripheral part of the cornea, and so causes the stagnation of secretion; this readily leads to ulceration. It consists of a small celled infiltration of the conjunctiva, and accompanies very severe conjunctivitis, especially gonorrhœal, as well as inflammations of the cornea and iris.

It is distinguished from œdema by its colour, denser consistence, and situation, since it may occur at any part of the circumference of the cornea, while œdema is localised in the neighbourhood of perforating wounds, or in the dependent part by gravitation of the fluid.

Treatment. Chiefly that of the primary disease, of which it is merely a symptom. Only when it projects far over the cornea should the tumour be scarified with a Graefe knife or a paracentesis needle. In such cases the corneal margin is to be minutely examined and any infiltration developing there immediately treated. As a prophylactic measure the secretion which has collected is to be cautiously washed out,—not wiped away, lest the epithelium be injured.

Conjunctivitis. I. Acute Forms.

These are characterised by redness and swelling of the conjunctiva and increased watery, mucoid, or purulent discharge.

In severe cases : œdema of the lids and conjunctiva, hæmorrhages, and chemosis ; deposit of fibrinous membranes, pale infiltration and necrosis of the conjunctiva (conjunctivitis crouposa and diphtheritica), formation of follicles (acute catarrh (Schwellungskatarrh), atropin conjunctivitis, acute trachoma), formation of pustules (conjunctivitis phlyctenulosa, pustulosa, ex acne).

Complications. Ectropion, keratitis suppurativa, hyperæmia, and inflammation of the iris.

Conjunctivitis catarrhalis is a typical example of an acute inflammation of the conjunctiva ; its treatment will therefore be described in detail, and in the other forms only symptoms of diagnostic importance and special therapeutic measures will be mentioned.

Conjunctivitis catarrhalis acuta.

The sovereign remedy in all acute inflammations of the conjunctiva is silver nitrate. It is painted on in 2 per cent. solution.*

The conjunctiva, especially the fornices, is first thoroughly freed from secretion with a moist piece of cotton wool, and then washed out with water or salt solution. Care is taken that the caustic solution does not come into contact with the cornea. The application must be made neither too superficially nor too deeply, for in the first case the action is too slight and transitory, while in the latter necrosis of the conjunctiva may result.

When the manœuvre is properly carried out the conjunctiva will be covered with a bluish white, milky eschar. If there are deep eschars the next application should be postponed until these are thrown off.

The transient increase of subjective symptoms caused by the action of the silver may be lessened by cold applications with water or lead lotion, the latter being, however, contra-indicated when the cornea is involved. If the pain is very

* If camel's hair brushes are used, each patient must have his own. It is much more convenient to use thin slips of wood, *e.g.*, wooden matches ; the ends are wrapped round with cotton wool, and they are thrown away after being used once.

severe, a 3 to 5 per cent. solution of cocain may be instilled, but in no case must this anæsthetic be given to the patient himself, since its frequent use is injurious to the corneal epithelium. The use of adrenalin hydrochlor., 1 in 1000, also diminishes the pain by vaso-constriction, but its action is only transitory.

The painting should only be repeated when the inflammatory symptoms again increase; it should not be done at night shortly before going to bed. It is generally sufficient to use the silver once, or at most twice daily, and best in the morning or afternoon. When much photophobia is present dark glasses are indicated, but the eyes should not be bandaged, as this causes harm by diminishing the blinking and hindering the free escape of the discharge.

After the subsidence of the more acute symptoms and the discharge, milder astringents may be employed—$\frac{1}{4}$ to $\frac{1}{2}$ per cent. argent. nit., 1 per cent. zinc. sulph., 1 to 2 per cent. zinc. sozoiodol., 1 per cent. alum solution, 3 to 6 per cent. sodii sozoiodol. (Cf. Chronic Conjunctivitis.)

Instead of silver nitrate other silver salts are used, *e.g.*, protargol 2 to 20 per cent. several times daily, as a collyrium in weak solutions, as a paint in strong, argentamin 5 to 10 per cent.; these are less painful than the nitrate, though this has been denied by some authors. In severe, especially purulent, conjunctivitis, itrol (silver citrate) can be used as a powder or 10 per cent. instillation, once or twice daily; it causes rapid diminution of the secretion.

The toilet of the eyes is of great importance: cleansing frequently with luke-warm water, 3 per cent. boracic acid lotion, or dilute potass. permang.; avoidance of injurious agencies—artificial light, smoke, dust, heat, wind; abstinence from straining at near work, especially in artificial light.

Finally, the danger of infection must always be borne in mind, and prophylactic measures inculcated—separate washing utensils and towels, frequent cleansing of the hands, etc.

Besides this local treatment the cause must naturally not be forgotten, particularly disease of the nose or lacrymal sac; above all, an endeavour must be made to obtain free outflow

for the tears and secretion—probing and syringing of the nasal duct, removal of hypertrophied lower turbinal bones, cauterisation of the mucous membrane of the nose, etc. When the lacrymal passages are blocked the lacrymal sac becomes a source of infection and an incubator for organisms, so that it must be extirpated or destroyed.

N.B. In unilateral conjunctivitis the lacrymal passages should always be investigated, since they are often the cause of the mischief.

Simultaneous catarrh of the respiratory tract must also obviously not be overlooked.

If the acute catarrh is complicated with formation of a membrane, extreme infiltration and necrosis of the conjunctiva, application of silver nitrate is only permissible after the membranes and necrotic parts are thrown off. Until then cleansing of the conjunctival sac with hydrarg. perchlor. (1 in 4000), or chinosol (1 in 6000), or potass. permang. (1 in 5000), or Kalt's irrigation with the last-named (cf. Blennorrhœa of the Conjunctiva) must suffice; removal of the necrotic parts can be hastened by the application of warm compresses. (Cf. Conj. crouposa.)

Varieties and special forms of Conj. cat. acuta

(*a*) **Vesicular Catarrh** (Arlt). Eruption of minute vesicles on the conjunctiva tarsi; severe photophobia and lacrymation: rare, in old people.

Treatment. As for conj. cat. acuta.

(*b*) **Hay Fever.** The patient complains of severe burning and pricking, photophobia and lacrymation, causing interference with the use of the eyes. The eyes themselves may appear normal, or show simple catarrh without specific symptoms. There is often nasal catarrh, and individual predisposition is marked. The disease occurs during the hay harvest, and when flowers are in bloom.

Treatment. Prophylaxis during the hay season. Cold compresses, instillation three or four times daily of 2 per cent. cocain solution, or better, use of snuff of eucain, which is less poisonous than cocain; once or twice a week a Russian bath, with thorough application of the cold douche to the closed eyes.

(*c*) **Ophthalmia electrica.** After the action of strong electric arc light at a short distance—short circuit, etc.

Symptoms. At first, for a short time, coloured scotomata, phosphenes, chromatopsia, and the sensation of a foreign body in the eye. After a few hours, severe pain, burning, lacrymation, photophobia, blepharospasm, and swelling of the conj. palpebr. et fornicis ; conj. bulbi only moderately injected ; often followed by an erythema. Permanent positive scotoma only occurs with simultaneous retinitis.

Treatment. Cold compresses, dark glasses, careful use of cocain (cf. Conj. cat. acuta), adrenalin. Cure follows in a few days.

(*d*) **Snow Blindness.** After exposure to intense glare of snow.

Symptoms and treatment as in (*c*), the condition being due to the same noxious influence of the chemical light rays.

(*e*) **Conj. exanthematica.** In the stage of incubation or eruption of measles, scarlatina, variola, erysipelas, and also sometimes during desquamation in measles and scarlatina. It manifests itself by severe photophobia.

Treatment. Protection from strong light ; cleansing of the eyes, and application of weak or strong astringents—collyria, silver nitrate—according to the severity of the conjunctivitis.

Conjunctivitis occurring in the course of chronic exanthemata is discussed under the appropriate headings—Conj. ex acne, pemphigus, lupus.

(*f*) *Acute Conjunctivitis accompanied by swelling and the formation of follicles.*

1. **Atropin Catarrh.** Swelling and redness of the conjunctiva, with mucous secretion and formation of numerous, fairly prominent follicles in the fornices, especially the lower. It occurs in some patients after prolonged use of atropin. It differs from the early stage of an acute trachoma, and from follicular catarrh, only in its course, for on suitable treatment it is invariably cured in a short time.

Treatment. Most important, immediate cessation of the use of atropin. If a mydriatic is necessary, a substitute must be

used—scopolamin hydrobromide ($\frac{1}{4}$ to $\frac{1}{2}$ per cent.), or duboisin sulphate ($\frac{1}{2}$ per cent.). (Hyoscin, a stronger mydriatic than atropin, should be avoided, on account of the ease with which symptoms of intoxication are induced.) This change alone often causes all the pathological features to disappear in slight cases or those of short duration. If there is much discharge and swelling of the conjunctiva, preliminary painting with 2 per cent. silver nitrate or thoroughly neutralised acetate of lead is indicated, and after the cessation of acute catarrhal symptoms the instillation of a 1 per cent. zinc sulphate or lead acetate solution. To combat the formation of follicles, the above collyria should be used, and the conjunctiva massaged with a 3 per cent. ointment of quite neutral lead acetate.

2. **Acute Catarrh accompanied by swelling** ("Schwellungskatarrh"). Contagious, frequently epidemic, pronounced swelling and infiltration of the fornices as in ordinary conj. cat. acuta, with formation of follicles. Often secondary in eczematous and scrofulous diseases of the eye—phlyctenules, scrofulous infiltration of the cornea.

Treatment. Cold compresses, painting with silver nitrate or protargol (cf. Conj. acuta), or insufflation of gallicin (gallic acid methyl æther). Later, after cessation of the discharge, collyria.

If the follicles do not soon retrogress, the course may be cut short and the danger of infection abolished by removing them mechanically. (Cf. Conj. trachomatosa.)

3. **Acute Trachoma.** Differential diagnosis from (1) and (2) is only possible if granulations are visible on the conjunctiva tarsi itself; but this is usually first observed after prolonged duration and chronic course, when the characteristic scars have already formed.

Treatment. (Cf. Conj. trachomatosa.)

(*g*) *Conj. acuta with the formation of pustule-like efflorescences.*

1. **Catarrhus pustulosus.**

Differential diagnosis from conj. phlyctenulosa: in the latter diffuse catarrh of the conjunctiva bulbi et palpebr. is usually absent, as well as the pathological discharge; on the other hand,

there is less photophobia in catarrhus pustulosus, and it generally occurs in adults.

Treatment. That of acute catarrh. Later, after cessation of the severe inflammatory symptoms, massage of the pustules with 1 to 5 per cent. yellow precipitate ointment. If this is not borne, xeroform, bismuthum loretinicum, or airol, may be used, either as a powder or an ointment (1 to 5 per cent.).

2. In *variola* there may be an eruption of pustules, chiefly on the conj. tarsi; and in *syphilis*, secondary papules may occur on the conj. tarsi et bulbi.

Differential diagnosis is effected through the general condition of the patient.

Treatment combats the acute conjunctivitis: massage with iodoform ointment and warm compresses are used for the efflorescences in variola; for the syphilitic papules, besides general antisyphilitic treatment, local massage with 3 per cent. boracic or 1 to 3 per cent. yellow precipitate ointment may be employed, the last-named being contra-indicated if iodide is given internally.

3. *Conj. phlyctenulosa.* (*Vide infra.*)

The discussion of the following types of acute conjunctivitis must be more exhaustive, and include short diagnostic notes, since apart from their great importance in surgical practice, they exhibit special symptoms and demand corresponding therapeutic measures.

Conjunctivitis blennorrhoica acuta sive adultorum (Conj. gonorrhoica).

Infection of the conjunctiva with gonococci, through transference of pus; extremely contagious. Incubation period, from a few hours to three days, according to the severity of the infection.

First Stage: *Infiltration*—lasting 2 to 4 days. Redness, swelling, firm infiltration of the lids, sometimes leading to complete closure. Profuse watery secretion mixed with yellow flakes. Conjunctiva of the lids much swollen, reddened, infiltrated, resembling coarse velvet, thickened. Croupous and diphtheritic membranes, with necrosis, may even be present. In these cases a definite diagnosis can only be made with the

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help of a bacteriological investigation. The simultaneous occurrence of urethral gonorrhœa is suggestive, but naturally does not eliminate the possibility of diphtherial or other parasitic infection (cf. Conj. crouposa). The conj. bulbi is chemotic and extremely tender to the touch: the preauricular glands are swollen. The condition differs from simple acute catarrh, in that this never causes such marked infiltration.

Second Stage: *Pyorrhœa.* Gradual retrogression of the swelling of the lids characterised by diminution of the tenseness and shiny appearance, and the development of fine wrinkles. Retrogression of the infiltration and chemotic swelling of the conjunctiva; moderate whey-like or creamy secretion, which quickly re-forms, in spite of frequent cleansing.

Third Stage: *Chronic Blennorrhœa.* Gradual diminution during the ensuing 4 to 6 weeks of the yet remaining inflammatory symptoms and discharge; the latter, however, usually ceases first.

A velvety hypertrophy of the conj. palpebr. of uniform red colour persists for a considerable time, and also a tumour-like thickening of the fornices; there are often, too, delicate scars. Apart from this typical course there are, on the one hand, abortive cases of much shorter duration, and but little involvement of the globe; on the other hand, cases which show such extreme infiltration that a diphtheritic condition is simulated, owing to partial necrosis and the formation of membrane.

Complications. Corneal ulcers, either central or marginal, the latter occurring when much chemosis is present, and being especially dangerous to the eye. In marginal ulcers the process usually ends after perforation of the cornea; in the central, however, a total prolapse of the iris is often unavoidable. Suppurative solution of the cornea may occur within a few hours. Late formation of corneal ulcers is less dangerous.

In general a very guarded prognosis must be given, even in the absence of corneal complications, for these may set in at any moment.

Treatment. Above all, prophylaxis by extreme care in

preventing access to the eye of gonorrhœal secretion or objects soiled with it—linen, clothes, dressings, instruments.

If gonorrhœal conjunctivitis has already occurred in one eye, a protective bandage must be applied to the sound eye, and the patient should lie upon his back, or still better, on the affected side, in order that the discharge may flow away from the good eye. The bandage must be applied with the utmost care to secure complete occlusion. The closed lids are first fixed together with court plaster, a pad of cotton wool laid upon this, and fastened with an oval piece of sticking-plaster, about double the size of the orbital aperture; little snips may be made in its periphery, so as to obtain closer adaptation to the uneven surface, and the edges are well painted with collodion elasticum. The bandage must be changed daily, or immediately if the eye becomes painful, and the condition of the eye inspected. It may be more easily examined if a watch-glass be included in the dressing. (Cf. Introduction: Bandages.) The changing of the dressing should always take place *before* the affected eye is touched, and the superficial layers—adhesive plaster, cotton-wool, and watchglass—removed under the supervision of the surgeon by a nurse whose hands have been carefully cleansed.

If catarrhal irritation occurs under the bandage, a watchglass must be used if this has not already been done. Its diameter should be greater than the bony margin of the orbit, and its edge should be protected by adhesive plaster or pads of wool or white gauze; the whole is secured to the skin with strips of plaster and the occlusion made complete with collodion. The advantage of this dressing is that the sound eye may be inspected at any time without removing the bandage, and a catarrh does no harm as it can be treated without delay.

If it is suspected that an eye has become affected with gonorrhœa, *e.g.*, in a practitioner who has been giving a vaginal douche, and if the eye shows only a slight catarrhal irritation and discharge, it is best immediately to paint the conjunctiva once with 2 per cent. silver nitrate. Experience has shown that washing out the conjunctival sac with sublimate solution is less effectual, for this often increases the irritation for some

time, and further, has no greater antiseptic action than silver nitrate or other silver preparations, which indeed seem to have almost a specific action on gonorrhœal conjunctivitis. The increase of irritation caused by these preparations is of short duration, so that, if the cause is not the gonococcus, return to the normal condition soon follows.

In undoubted gonorrhœal conjunctivitis, in the *first stage* iced compresses may be applied, and the eye frequently washed out with potass. permanganate solution of the colour of dilute red wine. This is to be preferred to sublimate solution, because it is less poisonous. If the swelling of the lids is so tense that they cannot be opened, this may be relieved, and the escape of the discharge and the cleansing of the conjunctival sac facilitated, by an extensive canthoplastic operation—temporary widening of the palpebral fissure by a free cut of the scissors in a horizontal direction at the outer canthus.

In the *stage of pyorrhœa* the treatment consists especially in most thorough and frequent cleansing of the conjunctival sac. This is best effected by the so-called Kalt's irrigation—1 litre of luke-warm potass. permang. solution (1 in 5,000) is allowed to flow into the eye from an irrigator under slight pressure ($\frac{1}{2}$ metre above the eye) four times daily, the lids being held open by the fingers ; especial care must be taken to thoroughly irrigate the upper fornix. Between the irrigations the eye must be cleansed every ten or fifteen minutes by the patient himself or a nurse with a piece of cotton-wool dipped in potass. permang. solution ; the cornea must not be too roughly scoured, lest erosions be produced.

It is highly important to insist repeatedly upon the danger of infection, and upon the necessity of immediately destroying (by burning) the wool, etc., used to clean the eye. The attendants and the patient himself must not fail to clean their hands frequently in a bowl of antiseptic lotion, kept always at hand—sublimate, lysol, bacillol, etc. Linen soiled with the discharge must be thoroughly disinfected by heat.

Besides cleansing the conjunctiva it should be thoroughly painted with 2 per cent. silver nitrate solution, at first twice, later, when the discharge is less profuse, once a day ; it should

afterwards be washed with salt solution. A convenient method of application is by a small piece of cotton wool wrapped round the end of a wooden or glass rod. Wooden rods have the great advantage over camel's hair brushes that, after being used once, they can be immediately burnt, and they are always sterile. The painting should be sufficiently energetic to cause the conjunctiva to be covered immediately afterwards with a delicate bluish milkiness—a superficial eschar. It is further of the greatest importance that: (1) all secretion should be first thoroughly removed; the fornices especially are to be brought as completely as possible into view, and well cleansed from all flakes of discharge adhering between the protuberant folds; (2) the cornea should not be touched by the caustic solution; corneal infiltrations, even when recent, do not contra-indicate the use of silver; and (3) the silver solution should be brought in contact with all the folds of the swollen conjunctiva. Large shell-shaped protective glasses should be worn by the attendants to protect their eyes from discharge which may spurt out when the lids are opened.

With regard to the silver preparations used by various authors—protargol (10 to 20 per cent.), largin (10 per cent.), argentamin (3 to 5 per cent.)—opinions are divided, but many state that their use is accompanied by less pain. Itrol (silver citrate) must, however, be regarded as an excellent substitute for argent. nit.; it is strongly bactericidal and speedily lessens discharge. The powder may be used as an insufflation twice a day, or a 1 in 2000 solution as a lotion.

A contra-indication to painting with silver is the presence of eschars in the conjunctiva induced by previous too energetic application, and also the infiltrations and necroses which accompany the severest forms of the disease.

Touching with 10 to 20 per cent. silver solution or with the silver stick is not to be recommended, because the depth of its action cannot be controlled, and there is danger of cauterising the cornea, if the excess of silver be not immediately and very thoroughly neutralised with salt solution.

Treatment of corneal complications, which occur only in the second stage, is carried out according to the general rules

applicable to infiltration and ulcer of the cornea—atropin, sublimate injections, etc. It may, however, be mentioned here, that a rapidly progressing ulceration is often favourably influenced by paracentesis of the cornea, with reopening of the lips of the wound on each succeeding day; in this manner perforation by the ulcerative process is avoided.

It is necessary immediately to excise the prolapsed iris after spontaneous perforation, in the quickly progressing marginal ulcers under the chemotic conjunctiva. If, however, there is no tendency to rapid spread of the ulcerative process, it is better to wait until the discharge has ceased or at least much diminished, on account of the danger of panophthalmitis. Unfortunately all these measures are often useless, especially in central suppurative softening.

In the *third stage* the treatment with silver nitrate should be continued long after the discharge has ceased; later, weaker astringents may be used to get rid of the hypertrophy, *e.g.*, instillations of $\frac{1}{4}$ to $\frac{1}{2}$ per cent. argent. nit., 1 per cent. zinc. sulph., zinc. sozoiodol., 1 per cent. alum, $\frac{1}{4}$ per cent. cupr. sulph., or touching with blue stone; lastly a lead ointment—plumb. acet. perfecte neutralisat. 0·5, vaselin. 15·0. While the first-named applications may always be used, copper and lead are absolutely contra-indicated when unhealed corneal ulcers are present.

Conjunctivitis blennorrhoica neonatorum. An acute purulent inflammation of the conjunctiva from infection with gonorrhœal pus from the genitalia. Inoculation usually occurs during birth, and the outbreak of the disease generally on the second to fifth days of life; if later, postnatal infection from the mother or, in institutions, from another patient, is to be presumed.

Symptoms. Like those of gonorrhœal conjunctivitis of adults (*q.v.*), but slighter, especially with regard to implication of the conj. bulbi (chemosis). Corneal complications may be avoided almost with certainty by timely and suitable treatment. The prognosis is therefore comparatively good.

Treatment is that of conj. gonorrhoica adultorum.

As regards prophylaxis, the vagina should be douched

antiseptically immediately before the birth, and after birth the *closed* eyes of the child should be carefully wiped. The bathing water should not be allowed to wet them ; after repeated external cleansing of each eye, a drop of 2 per cent. argent. nit. should be instilled—Créde's method.

P.S. It may be remarked here that blennorrhœal conjunctivitis, *i.e.*, with abundant muco-purulent discharge, may result in newborn children from other organisms, especially pneumococci and streptococci. A conclusive diagnosis can only be made with the microscope. The treatment is the same for these cases.

Conjunctivitis crouposa sive membranosa.

Ætiology. (*a*) Chemical irritation—silver nitrate, jequirity, alkalies (lime, caustic soda and potash, ammonia), acids, burns, steam ; the eschars caused by the simultaneous use of iodides internally and calomel insufflations also belong here.

(*b*) Micro-organisms—Koch-Weeks bacillus, gonococcus, pneumococcus, streptococcus, Löffler's diphtheria bacillus.

(*c*) Herpes iris conjunctivæ, the so-called benign form of chronic croup, with or without simultaneous herpes iris of the skin and mucous membranes.

(*d*) Croupous membranes are also formed after traumatic (including operative) and spontaneous (*e.g.*, after bursting of pemphigus bullæ) losses of substance in the conjunctiva.

Treatment. First, determination of the ætiology.

(ad *d*) No treatment except cleansing of the conjunctival sac is necessary. If contamination is thought to be present as shown by discoloration of the membrane, discharge, and considerable inflammatory reaction not remaining localised, stronger antiseptic lotions, and iodoform, xeroform, or airol, in powder or ointment, must be used. If there is much swelling and inflammation of the lids, compresses of 1 to 2 per cent. aluminium subacetate or lead lotion are to be employed.

(ad *a*) If a burn with alkalies comes under observation at once, neutralisation should be effected by freely washing out with acid solution, best boracic acid. In lime burns, in addition, the conjunctival sac must be thoroughly freed from all particles of lime, especially in its hidden recesses, best with

linen soaked in oil, the Daviel's scoop, or wool-covered probes. Andreæ advises irrigation with oil or glycerine, so as to surround the smallest particles, before washing them out with water. The sugar solution formerly used should, according to the latest researches, be given up, since it causes a greater development of heat than the free use of water, and further, the lime which enters the eye is usually already slaked.

Burns with acids occur more rarely, and are best neutralised by well washing out with soda solution.

Eschars from silver nitrate—*e.g.*, after too energetic painting, are to be treated antiphlogistically, on account of the accompanying inflammation. It is a fundamental rule not to forcibly remove the membrane, but to leave it to be thrown off spontaneously, or at most, to hasten this by moist, warm compresses. If the lids are much involved in the burn, being swollen, œdematous and painful, cold compresses should be used after first treating the cause.

Corneal complications are treated according to general principles.

Croupous inflammation caused by infusion of jequirity or jequiritol requires only antiphlogistic treatment and the stopping of the jequirity.

The dirty yellow eschars caused by mercury iodide demand the immediate cessation of the medication which has produced them—*i.e.*, calomel locally and iodides internally, especially the syr. ferri iodidi given in conj. phlyctenulosa sive scrofulosa.

(ad *c*) Herpes iris. (*Vide supra.*)

(ad *b*) If the causes described under (*a*) (*c*) (*d*) can be excluded with certainty, the special organism must be diagnosed with the microscope—cover-glass preparations, cultures. The patient, or his attendants, in the case of children, must be warned of the great danger of infection in gonorrhœa and diphtheria, and the other eye, if still intact, must be protected with a bandage. (Cf. Conj. blennorrhoica acuta.)

The local treatment consists in frequently washing out the conjunctival sac with antiseptics—potass. permang., hydrarg. perchlor., cresol, protargol, itrol—removal of flakes of secretion

and *loose* membranes, and protection of the eyes from light. In diphtheritic infection an energetic serum therapy must be at once instituted. (Cf. Diphtheria of the Conjunctiva.)

After the membranes have been thrown off, the conjunctival sac is merely to be kept clean, and later astringents are to be used. If there is much discharge and relaxation of the conjunctiva, argent. nit. is best, otherwise the weaker collyria —zinc, alum, tannin. (Cf. Catarrh. conjunctivæ chronicus.)

Diphtheria of the Conjunctiva—*i.e.*, infection of the conjunctiva with Löffler's diphtheria bacillus, may assume all the forms of acute conjunctivitis, from a simple catarrh to a diphtheritic infiltration of the whole palpebral and bulbar conjunctiva. Necessary as is the certain diagnosis of "diphtheria," it is extremely difficult, since only a complete bacteriological examination with smears, cultures, and animal inoculations, gives a conclusive result. By the discovery of the diphtheria serum the diagnosis is, however, facilitated, because this important curative agent at the same time possesses much value in the differential diagnosis. Only true diphtheritic inflammations, though not all such, are cured speedily and with certainty, whilst forms clinically similar, but ætiologically different, are not influenced for good or ill.

The *treatment* is therefore conducted as follows :

If a patient comes to the surgeon with a membranous or diphtheritic inflammation, the latter must first attempt to decide upon a diagnosis as to the ætiology by an exact clinical history and examination of the genitals, nose, mouth, and throat. If possible a bacteriological investigation should obviously at once be undertaken. With regard to this it may be simply remarked here that the presence of rods like the diphtheria bacillus is not diagnostic, since the xerosis or pseudodiphtheria bacillus behaves similarly both to stains and in cultures, and can only be distinguished by its virulence to animals. The absence of bacilli, however, and the presence of cocci—pneumo-, gono-, staphylococci—decide the diagnosis, and the treatment to be chosen.

If the bacteriological result is positive or even suspicious,

serum injections should be begun at once, and according to the severity of the case with Nos. 1, 2, or 3.

Behring Serum: No. 1 (green label) contains 600 antitoxin units in 1·5 cc.

No. 2 (white label) contains 1000 antitoxin units in 2·5 cc.

No. 3 (red label) contains 1500 antitoxin units in 3·75 cc.

Vienna Serum: No. 1 contains 700 antitoxin units in 6 to 10 cc.

No. 2 contains 1000 antitoxin units in 6 to 10 cc.

No. 3 contains 1500 antitoxin units in 6 to 10 cc.

Vienna serum (*a*) contains 1000 antitoxin units in 3 to 5 cc.

Vienna serum (*b*) contains 1500 antitoxin units in 3 to 5 cc.

Merck's excellent serum contains 600 to 1000 antitoxin units in 2 cc.

In moderately extensive diphtheritic infiltration, No. 3 Behring, or Vienna serum (*a*) or (*b*), or Merck's preparation is employed at once, and the whole contents of a bottle are injected into the carefully disinfected skin of the belly or lid.

There is absolutely nothing to be feared from the œdema and anæmia which result, especially in small children, after the injection of 4 cc. or even 10 cc. (Vienna serum) into the skin of the lids of one eye, for this soon disappears completely. If both eyes are affected the quantity is distributed between all four lids. In the next few hours after the injection a slight rise of temperature is frequently observed, which, however, soon passes off, while the general condition is improved.

The injections are to be repeated daily in the same quantity and strength, so long as membranes and infiltrates are still visible.

At the same time serum may be instilled into the conjunctival sac.

Corneal complications are not influenced to any great extent by the serum therapy. They must be treated according to the ordinary rules—atropin, warm compresses, etc.

Apart from the injections, the conjunctival sac must be frequently cleansed—1 in 5000 potass. permang., Kalt's irriga-

tion with 1 in 4000 hydrarg. perchlor. or chinosol, 2 to 10 per cent. protargol, 10 per cent. itrol.

The membranes and deposits are only to be removed when this can be effected by lightly stroking with a moist piece of cotton wool. Warm antiseptic compresses, along with the serum injections, hasten their removal. (Cf. Conjunctivitis crouposa.)

That prophylactic measures, as in blennorrhœa, must be insisted on, goes without saying—protective dressing for the other eye, if normal; burning of all wool, linen, etc., used to cleanse the eye.

When the formation of membranes has ceased, and the necrotic parts have been thrown off, the cleansing of the conjunctival sac must naturally still be continued for a considerable time. The temperature must be closely watched, and if it rises again after being normal for some time, the cause must be sought—nose, throat, abscess of the preauricular gland in mixed infection, etc. In two or three weeks even severe cases are usually cured. If hypertrophy of the conjunctiva remains, astringents are to be used.

Conjunctivitis diphtheritica is a higher degree of conj. crouposa, inasmuch as fibrin is deposited *in* the tissue of the conjunctiva, and necrosis follows. It therefore always leaves scars behind, which, however, in the course of time become scarcely noticeable.

Ætiology is the same as in croupous conjunctivitis, except that the action of the materies morbi is more intense.

Treatment. Above all, the membranes should not be forcibly removed, but antiphlogistic measures and antiseptic douching used. (Cf. Conjunctivitis crouposa.)

Conjunctivitis phlyctenulosa (eczematosa, scrofulosa, lymphatica) occurs in the following forms:

(*a*) *Phlyctenules.* Flat, red nodules of the size of a pin's head, or larger, situated in the midst of a zone of injection, developing in a few days into small whitish ulcers, with dull surface, and healing without leaving any trace. They occur chiefly at the limbus, at the apex of an injected sector of the conj. bulbi—*marginal phlyctenules*, but may also be situated

in other parts of the bulbar conjunctiva, or even in the conjunctiva of the tarsus.

(*b*) If the marginal phlyctenule heals peripherally, but progresses over the cornea, it loses its nodular form and becomes an only slightly raised infiltrate, in consequence of the dense structure of the corneal parenchyma; it draws after it a band of vessels, and is known as *keratitis fascicularis*. In the fresh condition it forms a grey, shallow, radial, tongue-like groove, in which the vessels run, while the central end shows a whitish-grey infiltration. A characteristic scar is left throughout life.

Participation of the cornea may also assume the following forms:

1. *A superficial infiltrate*, the equivalent of a conjunctival phlyctenule, which either becomes absorbed or breaks down into an ulcer.

2. The so-called *deep scrofulous infiltration*. A grey white or yellowish opacity, situated in the deep layers of the cornea, with a dull stippled surface. In severe cases it breaks down and gives rise to an extensive ulcer; in favourable cases it is absorbed, leaving a cicatrix, which in the course of time may clear up to a considerable degree.

3. *Vesicular eruption on the cornea*, with much photophobia. Simultaneous swelling and inflammation occur in the palpebral conjunctiva, which may be covered with little blebs, and thus give the appearance of being strewn with fine sand.

4. *Pannus*. A superficial deposit of a gelatinous grey tissue, over which the surface is lustrous but uneven, and which is pervaded by numerous superficial vessels. Localised infiltrates may occur, and the pannus heals by cicatrisation, but is capable of clearing up to a remarkable degree.

Phlyctenular conjunctivitis is characterised by much photophobia and blepharospasm; as a result of the congestion from the spasm of the orbicularis the lids become œdematous and boggy. The palpebral fissure can often only be opened with great difficulty, especially since painful rhagades are frequently present at the outer canthus.

Sequelæ. Entropion spasticum, ectropion spasticum and

organicum (from great swelling of the conj. bulbi), blepharitis squamosa, and especially ulcerosa.

Treatment. In anæmic and scrofulous children, prophylaxis is particularly important. From this point of view may be mentioned: living in dry, sunny rooms, which must be thoroughly ventilated, plenty of exercise in fresh, dry air, good nourishment—mixed diet, including fresh vegetables; for drinking, good water and milk, weak coffee, no tea, no alcohol; absolute cleanliness, especially with regard to pediculi, and general improvement of the physical tone of the children.

If the conjunctivitis has already actually broken out, then in addition to the above measures brine and sea baths, cod liver oil —pure or with ol. menth. pip. (2 drops to a tablespoonful), only in the cool part of the year—iron, arsenic, and creosote, are to be recommended. A method which has been advocated is treatment with soft soap: 1 to 1½ tablespoonfuls of the ordinary sapo mollis, somewhat diluted with warm water, are gently rubbed into the skin of the back or gluteal region for 10 to 15 minutes every other evening with the hand or a piece of cotton wool; warm water is then poured on, and the child is dried and put to bed. This treatment not only improves the general condition and appetite of the patient, but also has a beneficial action on infiltrates and ulcers of the cornea.

Before passing on to the treatment of the affections of the conjunctiva and cornea, we must first mention some concomitant conditions, the treatment of which is of the greatest importance. The chief of these are *photophobia* and *blepharospasm*, which are very pronounced in conj. phlyctenulosa, but stand in no constant relation to the severity of the disease.

The most efficient method is by forcible cold douching on the head and face, or immersion of the head in cold water. It is useless to be too soft-hearted, since only energetic treatment on the part of the attendants is of avail. Frequent instillation of cocain in the morning is also at first effectual, but this is only transitory. If, however, one succeeds for a few times in overcoming the blepharospasm and photophobia, even temporarily, the desired object is often already attained, and the children keep the eyes at least partly open. Instead of cocain,

instillation of 10 per cent. solution or dusting in of solid dionin may be employed, but its action is not so certain in these cases as in the blepharospasm and photophobia of keratitis, especially K. interstitialis. In obstinate cases which defy these measures, a canthoplastic operation must be performed. A bandage is only indicated in recent ulcers or deep infiltration of the cornea. The room may be *moderately* darkened.

Fissures at the outer canthus and *blepharitis ulcerosa* should be got to heal as quickly as possible. For this purpose touching freely with the silver stick is to be recommended, afterwards wiping with pieces of cotton wool moistened in salt solution, and covering the eschars with 1 per cent. ung. hydrarg. amm. *Œdema of the lids* may be treated with massage for a few days. The concomitant *eczema* of the skin (*q.v.*) should obviously be treated at the same time.

Finely precipitated calomel (which must be kept dry) or xeroform may be insufflated for the *inflammation of the conjunctiva*, and this may be combined with painting with 2 per cent argent. nit., and subsequent irrigation with water or salt solution, if there is much catarrhal discharge.

Phlyctenules. Insufflation of calomel, xeroform, airol, europhen, and also dionin (or the latter in 10 per cent. solution or 5 to 10 per cent. ointment). This treatment is to be carried out for some time after the inflammation has ceased, in order to avoid recurrences.

In extensive ulcerated phlyctens massage with 1 to 3 per cent. ung. hydrarg. ox. flav.* is best.

N.B. *When calomel is used the simultaneous administration of iodides is absolutely contra-indicated.*

Corneal infiltration and ulcers. Hot fomentations with diluted (1 to 10) aluminium acetate (diluted on account of the danger of producing eczema), atropin only in pronounced hyperæmia or inflammatory swelling of the iris, since otherwise it increases the dazzling and photophobia owing to the mydriasis. When actively progressive, subconjunctival in-

* It is essential in the preparation of this ointment that the mercury salt should be as finely divided and as uniformly distributed throughout the vaseline as possible.

jections of sublimate or salt solution; when perforation threatens, paracentesis of the anterior chamber or scraping of the infiltrated base or margin, and covering with a conjunctival flap, or touching with absolute alcohol or formalin solution. In the latter case the eye must be immediately freely irrigated with water.

Prolapse of the Iris. Excision of the prolapse under a general anæsthetic. In large prolapses the loss of substance may be afterwards covered with a conjunctival flap.

In the *regressive stage* massage with an ointment of hydrarg. perchlor., iodoform, xeroform, combined with atropin, may be used with advantage before proceeding to the use of the more irritating ointments. (Formulæ in the Appendix.)

Leashes of Vessels. If not progressive, the central end being lustrous, massage with 1 per cent. ung. hydrarg. ox. flav.; if progressive, the central end showing yellowish grey infiltration and a dull surface, hot fomentations, atropin-sublimate ointment, subconjunctival injections of hydrarg. perchlor. or salt solution, cauterisation or scraping of the infiltration and covering with a conjunctival flap. The latter measures should only be delayed when the apex of the leash is still well outside the pupillary area, otherwise every effort must be made to cut the process short.

Pannus. (Cf. Cornea.)

In quite recent gelatinous pannus cold compresses to produce contraction of the vessels, peritomy, slitting, or lineal cauterisation of the larger vessels, so as to destroy them, are indicated. Also massage with 1 to 3 per cent. ung. hydrarg. ox. flav.

Old cicatricial evascular pannus should be massaged with 5 to 10 per cent. yellow precipitate ointment either through the lids or directly, after cocainising, with a Daviel's spoon or glass rod. When the conjunctiva is quite free from inflammation treatment with jequiritol * may be commenced. (A complete outfit with directions may be obtained from the firm of Merck, in Darmstadt.)

* The earlier injurious use of 3 to 5 per cent. infusion of jequirity is now entirely given up, and is superfluous, since the solution of jequiritol allows of exact dosage and is much more convenient in application.

Ectropion spasticum, when pronounced, requires the use of Snellen's sutures (cf. Ectropion). Energetic massage several times a day should be used for the thickening of the lids from congestion and inflammatory œdema.

Entropion spasticum (*q.v.*) is rarer. Canthoplasty; excision of a horizontal fold of the skin.

Conjunctivitis trachomatosa (Trachoma, Ophthalmia granulosa, Granular Lids, Egyptian Ophthalmia) is a contagious conjunctivitis with velvety or raspberry-like papillæ on the conj. tarsi, or granulations, or a combination of the two. It is of chronic course, and ends in cicatrisation and shrinking of the conjunctiva. The granulations appear either as prominent, grey, transparent, gelatinous follicles in the swollen and inflamed conjunctiva of the fornices and semilunar fold, or as smaller, slightly prominent, ill-defined grey to yellowish-white follicles in the firmly adherent tarsal conjunctiva amongst the hypertrophied papillæ. The scarring in the lids occurs in characteristic form in the sulcus subtarsalis, in the tarsus—as reticular or diffuse cicatrices, which may lead to trough-shaped curvature, and in the fornices—leading to their complete obliteration.

Symptoms. Photophobia, lacrymation, sticking together of the lids, often pain. The conjunctiva is reddened, thickened, rough, and, according to the form of the disease, shows either papillary hypertrophy or spawn-like granulations arranged in rows (*vide supra*). The discharge is mucoid or muco-purulent, and the bulbar conjunctiva is merely injected in the form of a network. A slight degree of ptosis is present, giving a sleepy expression to the face (Ptosis trachomatosa).

Complications. Corneal: 1. Pannus—a superficial, gelatinous, vascular, uneven, grey deposit, which usually begins at the upper margin of the cornea. It cicatrises to a grey, cloudy opacity, without any, or with only a few, superficial vessels.

2. Ulcers.

(*a*) At the edge of the pannus.

(*b*) Central, indolent ulcer.

(*c*) Anywhere in the cornea, which is usually pannous.

Sequelæ. Palpebral: trough-like curvature, trichiasis, entropion from cicatricial contraction, yellow gelatinous thickening of the whole tarsus, ectropion from great hypertrophy of the conjunctiva.

Conjunctival: symblepharon posticum, xerosis conjunctivæ. In the latter condition, the secretion becomes greatly diminished, in consequence of the extensive shrinking; it is thready and tough, and the conjunctiva becomes drier and drier, and covered with fatty plaques. Xerosis is at first partial and confined to the palpebral fissure, but later becomes total (Xerophthalmos).

Corneal: these depend upon the extent and situation of the ulceration—cicatricial opacities, anterior synechiæ, staphylomata, ectasiæ, etc. Keratectasia e panno, xerosis corneæ.

Treatment. Prevention of infection, which only occurs through contact. When *mucopurulent discharge* is present painting with 2 per cent. argent. nit. is best. Painting with 5 to 20 per cent. protargol, ½ to 3 per cent. ichthargan, instillations of 1 to 4 per cent. solution of iodine in glycerine or vaseline oil, or touching with the iodic acid pencil, along with simultaneous internal administration of potassium iodide, present no notable advantages, and have not so far obtained any universal recognition.

With *serous discharge* instillations of lead acetate (plumbi acet. basic. solut. ½ to 2 per cent.), or applications of tannin 1·0, acid. borac. 3·0 as a powder, or tannin 1·0, ung. glycer. 20·0 * as an ointment may be tried.

After the cessation of the discharge and papillary hypertrophy, and in the absence of progressive or infiltrated corneal ulcers, the conjunctiva should be touched once daily with the copper sulphate stick,† or copper citrate as a 5 to 10 per cent. ointment with ung. glycer. applied three times daily.

* Ung. glycerini: Starch 10, Water 15, Glycerin 90.

† After eversion of the lid the stick is applied with light pressure to the conjunctiva and around the upper border of the tarsus into the upper fornix, care being taken not to touch the cornea. A clean piece of linen is then laid upon the conjunctiva to soak up the excess of strongly caustic copper sulphate solution.

In moderate hypertrophy copper sulphate in $\frac{1}{4}$ per cent. solution or $\frac{1}{2}$ per cent. ointment, or the alum stick is serviceable.

In *granular forms* the duration of treatment, and therefore the danger of infection, may be shortened by mechanical removal of the follicles, and this is unconditionally indicated. It may be performed in various ways: pressing the follicles out between the finger nails, and subsequent repeated friction with 1 in 2000 sublimate solution (Keining); expression of the granules with the Sattler-Knapp roller forceps, or Kuhnt's expressor, with or without previous scarification.

Opening of the individual follicles with the galvano-cautery has been recommended, especially when only a few isolated ones are present in the tarsus.

Excision of the upper fornix is not performed so often now, since we have in expression a means of thoroughly removing the granulations without sacrificing any of the conjunctiva. It should only be undertaken when there is marked gelatinous thickening of the tarsus, the upper half of which should then also be removed (Kuhnt). Similar treatment may rarely be required in the lower lid.

When isolated collections of follicles are situated upon the conj. bulbi, these yellowish-red gelatinous tumours should be excised.

Expression must be done thoroughly, and special attention must be paid to follicles situated at both ends of the upper fornix, and in the semilunar fold. Thorough cocainisation is essential; it is a good plan to inject cocain into the fornix, since this makes the folds tenser and more prominent.

The operation is performed as follows: The surgeon, wearing protective glasses, everts the affected lid, and causes the fornix to project. One limb of the roller forceps is pushed up between this and the conjunctiva bulbi, while the other is laid upon the projecting folds. The two limbs are now pressed together with moderate force, so as not to miss any deep-lying follicles, and are drawn in a horizontal direction from one end of the fold to the other. Expression of the follicles of the tarsus and of the gelatinous tissues in it is performed by grasping the lid between the rollers of the instrument and

squeezing them out; the semilunar fold is similarly treated. Before using the roller forceps the follicles may be pricked with a Græfe knife or pointed bistoury, in order to facilitate their evacuation.

After the operation, cold compresses of water, lead lotion, or diluted sublimate, or 1 to 2 per cent. aluminium subacetate are applied. Only after the swelling of the lids and conjunctiva has gone down, and after the sloughs caused by the crushing of the tissues have been thrown off, should silver nitrate or copper preparations be used.

Treatment of Complications and Sequelæ.

Corneal Ulcers. Ectasia corneæ (q.v.). If the condition of the cornea requires treatment with silver nitrate, these sequelæ do not contra-indicate it, but copper and lead preparations must never be used so long as the ulcers are not completely healed.

Pannus is often favourably influenced in its early stages by merely painting the conjunctiva. If very thick, it may itself be painted with silver nitrate, or it may be carefully touched with the copper-stick, or a peritomy or peridectomy may be performed. Destruction of the vessels of supply with the galvano-cautery has been advised.

Old evascular, already cicatrising pannus demands energetic massage: 3 to 10 per cent. yellow precipitate, ½ per cent. copper sulphate, or 5 to 10 per cent. cuprocitrol ointment is rubbed over the cornea for 2 to 4 minutes once or twice daily, either through the lids or directly after cocainising, with a Daviel's spoon or a glass rod.

The jequirity treatment often causes much lessening of the corneal opacity, and gives excellent optical results, in old cicatricial evascular pannus where there are no inflammatory symptoms in the scarred conjunctiva. It consists in the energetic painting of the conjunctiva and cornea two to three times daily with a freshly prepared 3 to 5 per cent. infusion of jequirity beans;* this should be continued until a croupous

* The infusion is prepared by thoroughly pounding 3 to 5 parts of jequirity seeds, macerating for 24 hours in cold water, straining, and making up to 100 parts.

membrane is produced—jequirity ophthalmia—and then the painting should be stopped, antiphlogistic measures being employed. The inflammation passes off in a few days.

Recently the alkaloid jequiritol extracted from the seeds with glycerine has been used as an instillation. It is prepared in four exact grades of strength, and on account of its greater convenience, easier preparation, and exact dosage is much to be preferred to the infusion. (Complete outfit with directions may be obtained from the firm of Merck in Darmstadt.)

Cicatricial curvature of the lid, with its consequences—*entropion* (*q.v.*), *trichiasis* (*q.v.*)—as also *ectropion* (*q.v.*), require operation.

Symblepharon in itself requires no special treatment, since it never becomes sufficiently great to cause trouble as long as the eye remains useful.

Treatment for *xerosis*, *xerophthalmos* (*q.v.*), can only be palliative, not curative.

Old cicatricial trachoma without follicles and with little hypertrophy, but with catarrhal discharge, requires weak collyria, such as are used in chronic conjunctivitis.

II. **Chronic Forms of Conjunctivitis.** These may occur as such primarily, or remain after an acute conjunctivitis, especially blennorrhœa and trachoma.

They are characterised chiefly by subjective symptoms, which are particularly pronounced in the evening—burning, itching, sometimes photophobia, frequent blinking, feeling of sand in the eye, heaviness of the lids, rapid fatigue at work especially in artificial light, rainbows round lights, removable by wiping and rubbing the lids and caused by flakes of discharge. The objective symptoms are always slight, and reddening and discharge often but little marked, or entirely absent. The conjunctival secretion may even be below the normal. (Cf. Catarrhus siccus.)

The most common form is **Hypertrophy of the Conjunctiva.** This consists in a uniform reddening and velvety or raspberry-like thickening of the tarsal conjunctiva. The yellow tarsus is entirely concealed by the thickened conjunctiva, whereas in

hyperæmia or slight acute inflammation it is visible under the net of injected vessels.

A special form is the so-called *Catarrhus angularis* or angular blepharo-conjunctivitis, which is characterised by slight mucoid discharge and maceration of the skin at the canthi; here also grey, greasy flakes of discharge collect.

Conjunctivitis catarrhalis chronica.

Ætiology. Mostly in adults, especially old people—Catarrhus senilis.

Remaining after acute catarrh; general injurious agencies—heat, smoke, dust, bad air, late hours, abuse of alcohol, etc.; prominence of the eyes, lagophthalmos—from insufficient protection by the lids; blepharitis, eczema, ectropion of the lower lid, prolonged bandaging, overuse of the eyes, errors of refraction—hypermetropia, astigmatism; permanent irritation from foreign bodies—infarcts of the Meibomian glands, misplaced lashes, etc.; diseases of the lacrymal sac, strictures of the nasal duct, chronic rhinitis.

Complications. Blepharitis, eczema palpebræ inferioris, eversion and ectropion of the lower lid with its sequelæ, blepharophimosis, corneal ulcers.

Treatment. 1. Causal. Avoidance of the above-mentioned injurious agencies, correction of errors of refraction, treatment of the lacrymal passages and diseases of the nose, removal of foreign bodies and infarcts, rectification of trichiasis—when only a few cilia are misplaced, electrolysis; otherwise operation, etc.

2. Local. When there is discharge argent. nit. as a paint (2 per cent.) or collyrium (¼ to ½ per cent.); in hypertrophy the alum stick, lead ointment—plumbi acet. perfecte neutralisat. 0·15, vasel. alb. 5·0; 1 per cent. zinc sulphate, 1 to 3 per cent. protargol, 3 to 6 per cent. sodium sozoiodol, gallicin, europhen.

When the symptoms are chiefly subjective, and only slightly objective, astringent collyria may be used once or twice daily, but not in the evening: collyrium astringens luteum * (pure

* Ammonium chloride 0·5, zinc sulphate 1·25, dissolve in distilled water 200; add a solution of camphor 0·4 in dilute alcohol 20·0 and saffron 0·1. Digest for twenty-four hours with frequent shaking, and filter. (Horst's Eye Wash.)—Trs.

or with an equal quantity of water), tinc. opii; zinc sulph. (1 per cent.), zinc sozoiodol (1 to 3 per cent.), especially in angular conjunctivitis; alum (1 to 3 per cent.), tannin (1 per cent.); adrenalin hydrochlor. (1 in 1000) has a good but transient effect in diminishing the itching.

Astringent lotions may be used once or twice daily (but not immediately before going to bed), as long as hyperæmia of the conjunctiva and subjective symptoms continue.

Catarrhus siccus conjunctivæ. A variety of chronic conjunctival catarrh in which the secretion is diminished. The patient complains of a feeling of burning and pressure, especially in the evening and at night, and also of a sensation as if the lids were stuck to the globe, so that the opening of the palpebral fissure seems to require an effort to tear them apart.

Treatment. Massage with 3 per cent. boracic ointment, or 1 per cent. yellow precipitate ointment, which is introduced into the conjunctival sac with a glass rod, particularly in the evening before going to bed; washing out with 3 per cent. boracic acid lotion three times a day and in the evening, and the weaker collyria—$\frac{1}{2}$ per cent. zinc sozoiodol, etc. (*vide supra*).

This form often defies all treatment, and only a temporary palliation can be attained. In such cases considerable improvement can often be brought about by scraping the tarsal conjunctiva once with a knife or sharp spoon (Peters), and subsequently rubbing it with 1 in 2000 sublimate solution.

Catarrhus follicularis or **Follicular Conjunctivitis** is distinguished from trachoma by the absence of marked inflammatory symptoms. The follicles are more sharply defined, more prominent, redder, and not gelatinous; the conjunctiva between them is but little, or not at all, swollen and red, and they are scanty or absent in the upper fornix, and never present on the plica semilunaris and bulbar conjunctiva. Definite diagnosis from trachoma can often only be made by observing the subsequent course; in follicular conjunctivitis contraction and scarring of the conjunctiva and corneal complications never occur.

It may be mentioned here that in chronic conjunctivitis of long duration isolated follicles are often developed in the outer part of the lower fornix.

Follicular catarrh may occur in epidemics, and is to be regarded as contagious. Prophylaxis is therefore necessary. The follicles disappear under prolonged use of 1 per cent. zinc sulphate or 1 to 3 per cent. protargol, and massage with lead ointment. (Cf. Conj. chronica.)

When the development of follicles is excessive the tedious course of the disease may be shortened by expression, as in trachoma.

Conjunctivitis ex acne. Development of flat, white nodules at the limbus, with sectors of injection of the bulbar conjunctiva. Inflammation of the conj. palp. et fornicis is moderate or absent. Recurrences are frequent.

It is distinguished from conjunctivitis phlyctenulosa and pustulosa:

1. By the age of the patients—conj. phlyctenulosa only in children.
2. Simultaneous acne rosacea.
3. Absence of inflammatory symptoms.

Treatment. Attention to the acne: locally, insufflations of calomel or xeroform, or massage with 3 per cent. boracic or 1 per cent. yellow precipitate ointment.

Catarrhus vernalis or **Spring Catarrh** (phlyctena pallida). Chronic thickening of the tarsal conjunctiva in the form of hard bluish-white, flat-topped papillæ ("cobble stones"), polygonal by mutual pressure, occurring especially in the upper lid; or as a fine bluish milkiness over the conjunctiva, chiefly of the lower lid. More rarely yellowish, or greyish-red, hard, painless nodules are found at the limbus, and may invade the peripheral portion of the cornea. The eyeball is pale, and secretion is not increased. It occurs in the spring, with characteristic symptoms of itching and burning, and disappears spontaneously when colder weather sets in.

Treatment consists in combating the itching by xeroform in powder or 1 to 3 per cent. ointment, instillations of adrenalin,

massage with 1 to 2 per cent. white, or 5 to 10 per cent. yellow precipitate ointment. The troublesome subjective symptoms are much alleviated by frequent instillations of acid. acet. dil. gt. 1 to 10–20 cc. (dr. 3-6) of water.

For the nodules at the limbus, massage with 5 to 10 per cent. yellow precipitate ointment or sublimate vaseline (1 in 3000) is often beneficial.

If the cobble-stone papillæ are very large they may be removed, or destroyed with the cautery.

Chronic Croup. (Cf. Conjunctivitis crouposa.)

Ecchymoma subconjunctivale. Extravasation of blood under the conjunctiva in the form of irregular light or dark red spots of various sizes; these in a few days become gradually yellowish-red and finally disappear without leaving a trace. Only in very extensive cases is a yellowish discoloration of the conjunctiva left for a considerable time, owing to the imbibition of the colouring matter of the blood.

Ætiology. 1. After operations, injuries, and severe inflammations, especially ophthalmia catarrhalis.

2. Spontaneously, especially in old people with brittle vessel walls.

3. After severe bodily strains or forced expiration—cough, especially whooping cough in children, sneezing, vomiting, straining at stool.

4. Symptomatic of fracture of the base of the skull in head injuries.

Treatment. Merely a placebo—cold boracic acid compresses. To prevent recurrences, avoidance of causes mentioned under 3.

Hyperæmia of the Conjunctiva.

Ætiology. That of conjunctival catarrh, of which it may be the preliminary; or secondary to hyperæmia of the iris, sclera, choroid, and retina.

Treatment is directed first to the removal or combating of the cause (cf. Conjunctivitis). For the subjective symptoms —itching, burning, pain, feeling of sand in the eye—cooling application of lead lotion, or 1 to 2 per cent. aluminium subacetate, washing out of the conjunctival sac with 3 per

cent. boracic acid lotion; when much secretion, weak collyria —½ per cent. zinc sulphate or sozoiodol.

N.B. Cocain and the other local anæsthetics and analgesics should not be used, since they only act for a short time, do not affect the cause, and injure the epithelium.

Injuries, Burns, etc., of the Conjunctiva.

Injuries. Patients often come to the surgeon complaining of the feeling of a foreign body in the eye, which they attribute to dust, coal, etc. The affected eye shows hyperæmia of the conjunctiva, lacrymation, photophobia, and often severe pain. In such cases the whole conjunctival sac must be searched, the upper lid being everted and the fornix examined; so too the cornea for abrasions and foreign bodies, if necessary with the help of a loupe and oblique illumination. Foreign bodies are to be removed; only splinters of stone and powder granules which have penetrated deeply into the conjunctiva may sometimes be left, since they cause no reaction. A foreign body is not always to be found, for the irritation set up by it remains for a while after its disappearance. Cold compresses alleviate the irritation; cocain and other local anæsthetics are to be avoided on account of their transient action and their deleterious effect on the corneal epithelium. It is further to be noted that catarrh of the conjunctiva produces similar objective and subjective symptoms. If there is much discharge and the conjunctiva is swollen and injected, instillations of 3 per cent. boracic lotion or ¼ to ½ per cent. zinc sulphate or sozoiodol are to be used.

A characteristic picture is produced by the irritation of caterpillar hairs, which cause inflammatory nodules—*ophthalmia nodosa.* These may also occur in the iris. The removal of the hairs or, when these are concealed in the nodule, the excision of the latter is indicated.

Lacerations of the conjunctiva are always surrounded by ecchymoses; when clean and not extensive no treatment is necessary except a bandage, under which they soon heal. Larger wounds should be united by silk or catgut sutures, which may be removed after four to six days. It may be mentioned that even clean wounds of the conjunctiva become

covered with a fibrinous membrane, which is distinguished from that of croup or diphtheria by its localisation, white colour, and shiny surface.

Infected wounds, with marked inflammatory reaction, greyish yellow coating, or even subconjunctival abscess, are treated with antiseptic douching, or the cautery.

If the underlying structures—sclera, uvea—are injured, treatment must be directed to these complications. (Cf. Injuries of the Sclera.)

Burns. Action of Caustics. Slight action produces hyperæmia of the conjunctiva (First Degree), deeper action an eschar (Second and Third Degrees), and cicatrisation after throwing off the slough, often with symblepharon as a sequel.

Treatment. Burns of the First Degree—by hot water, ashes, steam, molten metal—require the removal of any foreign bodies, cold compresses, douching of the conjunctival sac with boracic lotion or a pale red solution of potassium permanganate, and simultaneous treatment of any complications which may be present—corneal abrasions, hyperæmia of the iris, etc.

Action of Caustics (First Degree). Above all, the caustic must be neutralised and removed—if acid, by freely douching out the sac with 1 to 2 per cent. soda solution; if alkaline, with 3 per cent. boracic acid lotion. In lime burns, after cocainisation, any remaining particles of lime must be removed, especially from the upper fornix, with a piece of linen or wool dipped in oil, or with a fine pair of forceps, spatula, or Daviel's spoon. Afterwards the whole sac, especially the upper fornix, must be thoroughly washed out with pure water or oil. Sugar solution should not be used, as it dissolves the lime. It is also admissible to use glycerine, followed by douching with water. Afterwards cold or moist hot compresses.

If the cauterisation or burn has led to the formation of an eschar, it suffices to frequently clean out the sac according to the above rules, and to endeavour to avoid symblepharon after the throwing off of the slough by repeatedly freeing the adhesions, or by inserting a strip of tin foil, gold beaters' skin,

guttapercha tissue, or linen, smeared with vaseline, between the opposed surfaces.

If the burn has not affected two contiguous areas, symblepharon need not be feared ; in this case, after the sloughs have been cast off, the granulating surface may be gently massaged with boracic or iodoform ointment.

Lupus of the Conjunctiva. (Cf. Ulcers of the Conjunctiva.)

Œdema of the Conjunctiva.

1. *Inflammatory.* A concomitant of many inflammatory processes of the lids (hordeolum, erysipelas), of the orbital margin (periostitis), of the lacrymal sac, of the conjunctiva, of the globe (keratitis, iritis, choroiditis, panophthalmitis, scleritis), and of the orbit (dacryoadenitis, orbital cellulitis, tenonitis).

In old people œdema may even occur in consequence of a simple conjunctival catarrh.

2. *Non-inflammatory.*

(*a*) In venous congestion and hydræmia, rarely in albuminuria.

(*b*) Filtration œdema—after perforating wounds, including operations, in the anterior part of the sclera ; it is due to infiltration of the aqueous between the unhealed edges of the wound under the conjunctiva. It may remain permanently in "cystoid cicatrices."

Diagnosis from Chemosis. (Cf. Chemosis.)

Treatment.

ad 1. That of the primary disease. The œdema only requires special treatment when it is so great that the lids cannot be completely closed ; the lid margins are then brought into apposition with the fingers, and fixed with vertical strips of court plaster, over which a bandage is applied. If even passive closure of the lids is impossible, scarification or partial excision of the œdematous swelling may be performed.

ad 2 (*a*). Treatment of the corresponding general disease.

ad 2 (*b*). Occlusive bandage after excision of any tissue which may be incarcerated between the edges of the wound, preventing healing. For cystoid cicatrices, *vide infra.*

Pterygium demands removal by operation when it is progressive, as shown by its grey, gelatinous edge, and its approaching the pupillary area ; or for cosmetic reasons.

The simplest method (Arlt) consists in carefully dissecting up the head—*i.e.*, the part on the cornea, with a keratome under local anæsthesia ; this is then raised and cut off with a stroke of the scissors at its junction with the episcleral part. The edges of the wound in the conjunctiva bulbi are then brought together with stitches, which are cut short and left for five to seven days ; in broad pterygia incisions may be made at the limbus upwards and downwards to relieve tension. The exposed surface on the cornea is scraped. For other more complicated methods the text-books must be consulted.

Pseudopterygium or **Cicatricial Pterygium** occurs in consequence of peripheral corneal ulceration—especially in blennorrhœa, diphtheria, burns, action of caustics, keratitis marginalis superficialis. During the cicatrisation of these the neighbouring chemotic conjunctiva becomes adherent to the surface of the ulcer, or in kerat. marg. superf. the conjunctiva becomes drawn inwards.

Differential diagnosis from true pterygium.

1. Pseudopterygia may occur at any part of the periphery of the cornea, true pterygia only outwards and inwards in the horizontal meridian.

2. A thin probe can be passed under the whole width of pseudopterygia at the limbus, in true pterygia only for a very short distance under the border.

Pseudopterygia require operative removal only when from their great size they limit the movements of the globe. The operation is the same as for true pterygia.

Spring Catarrh. (See under Conjunctivitis.)

Subconjunctivitis, episcleritis periodica fugax (Fuchs), pseudoscleritis (von Reuss), consists in œdema and much redness of the conjunctiva bulbi, patchy or diffuse. Subconjunctivitis is distinguished (*a*) from true episcleritis by its more superficial situation, short duration, and absence of bluish tender nodules ; (*b*) from conjunctivitis by the absence of inflammation in the palpebral conjunctiva and of increased

secretion. Phlyctenular infiltrates and conjunctival pustules can only be mistaken for it at their commencement.

Ætiology. Rheumatism, gout; sometimes unknown.

Treatment. Internally: quinine, salicin, aspirin; treatment of gout. Locally: douching with boracic lotion, massage with boracic or yellow precipitate ointment.

Symblepharon. Adhesions between the globe and the lids, which may arise on the one hand after ulcers on contiguous surfaces—diphtheria, burns, action of caustics; or on the other hand in consequence of cicatricial shrinking of the conjunctiva—trachoma, pemphigus. It requires treatment, which is solely operative, only if the movements of the eye or the active opening or closing of the palpebral fissure are interfered with.

The methods which may be employed vary according to the nature of the symblepharon. In symblepharon anticum, where there are only some bridge-like cords, the fornix remaining free, the desired result is attained by dividing the adhesions and preventing their re-formation. This may be done by inserting a strip of tin foil or gold-beaters' skin smeared with oil or vaseline, or by repeatedly freeing the adhesions, or by suturing one of the exposed surfaces, or covering it with a pedunculated conjunctival flap.

The cure of symblepharon posticum, in which the fornix is obliterated, or symblepharon totale is more difficult, and often succeeds only after repeated attempts. To describe the many complicated methods would exceed the limits of this book.

Syphilis of the Conjunctiva.

(*a*) *Primary Chancre.* (Cf. Ulcers of the Conjunctiva.)

(*b*) *Condylomata.* Very rare; white, flat; resembling pustules.

(*c*) *Gummata.* Never commencing in the conjunctiva, but invading it from surrounding tissues.

Treatment. General antisyphilitic.

Tuberculosis of the Conjunctiva. Usually in the form of ulcers (*q.v.*), rarely a pannus-like layer advancing on to the cornea. Painless, tedious course, with slight imflammatory symptoms.

Treatment consists in the excision of the diseased tissue as

freely as possible, and cauterisation of the exposed surface with the actual cautery; afterwards iodoform in powder or ointment (5 to 10 per cent.).

Tumours of the Conjunctiva.

I. *Benign.* These are the commonest:

1. *Angiomata.* Seldom primary, but invading the conjunctiva from the lids or orbit. For the treatment, see under Lids, Orbit.

2. *Cysts of the Conjunctiva.* These are of various origin, viz.:

(*a*) *Dilated lymphatics*—arranged in rows like a rosary or string of pearls, or as small tumours. They occur chiefly on the conjunctiva bulbi after inflammation, or on the normal conjunctiva.

Treatment is superfluous, even on cosmetic grounds; they are usually only noticed accidentally.

(*b*) *Dilatations of Krause's glands* in the lower fornix. If small, they are only seen on drawing down the lower lid, when they project from the fornix; when larger they form a swelling and are visible externally. They may be diagnosed with certainty by palpation—fluctuation, tense elastic consistence, deep situation under the skin, immobility when the lids move—and by everting the lower lid. When they cause annoyance by their size, extirpation is indicated; this must be complete, otherwise they will recur.

(*c*) *Traumatic Cysts.* If causing trouble they must be removed.

(*d*) *Cysticercus cellulosæ.* Usually in young people. Dilated vessels often course in the conjunctiva over it, and the cyst itself is either firmly adherent to its bed, or only slightly movable in it. When thin-walled the head of the parasite may be seen shimmering through as a dead-white spot. Its situation often corresponds with the insertion of a muscle.

Treatment. The overlying conjunctiva should be divided, the cyst shelled out, and the conjunctiva sutured; care must be taken not to prick or burst the bladder.

3. *Dermoid.*

4. *Lipoma subconjunctivale.*

Extirpation and suturing of the wound, either for cosmetic reasons or large size.

5. *Papillomata.* Thorough removal on account of the tendency to recur, and the possibility of carcinomatous degeneration.

6. *Polypi, Granulation Tumours.* Removal and cauterisation of the base.

II. *Malignant.*

Epithelioma. A flat tumour usually commencing in the limbus, and with much tendency to superficial degeneration.

Sarcoma. Almost always pigmented, tending to grow in thickness rather than laterally.

Treatment. Excision, as early and as thorough as possible. The incision must lie in healthy tissue, at least ½ cm. from the tumour. In large tumours the globe must be excised, or the orbit exenterated.

Ulcers of the Conjunctiva.

1. Tuberculosis.

2. Lupus—concomitant lupus of the skin or mucous membranes, especially of the nose. Flat but resistant edges; greyish red, spongy granulations and nodules in the floor and neighbourhood.

Treatment. ad 1 & 2. Excision, with subsequent cauterisation or massage with iodoform ointment.

3. From the breaking down of pustules and phlyctenules.

Treatment. Massage with 1 to 3 per cent yellow precipitate ointment, or insufflation of calomel if the ulcers are small.

4. After the throwing off of sloughs.

Treatment. Frequent antiseptic douching of the conjunctival sac with 3 per cent. boracic acid, 1 in 5000 potass. permang., or 1 in 4000 hydrarg. perchlor. lotion.

5. Pemphigus. The seats of election are the inner angle of the lid and lower part of the conjunctiva bulbi. Grey, dull areas, dry on the surface: rarely vesicles, with a red halo, which very quickly burst.

Sequelæ: shrinking of the conjunctiva—symblepharon, trichiasis—xerosis, lacrymation scanty or absent, ulcers of the cornea with xerosis.

Treatment is only palliative. Cold compresses, 1 in 8000 sublimate, or 3 to 5 per cent. iodoform ointment. In commencing shrinking operative treatment of the entropion and trichiasis—attempt to transplant mucous membrane. For the diminished secretion of tears, instillation of milk or glycerine, painting of the conjunctiva with soap lather, mucilago tragacanthæ. Internally tonics : arsenic, quinine.

6. Syphilis. Resulting from a primary sore (rare). Dense, red edges ; in the middle a velvety, red erosion, covered with a mucopurulent secretion.

Treatment. General antisyphilitic.

7. From ulceration of epitheliomata of the conjunctiva.

Treatment. Removal of the tumour by operation. (Cf. Tumours.)

Xerosis of the Conjunctiva is a symptom of

1. Local diseases :

(*a*) In cicatricial conditions of the conjunctiva, after trachoma, pemphigus, burns ; incurable. Treatment only palliative : instillations of oil, painting with mucilage, milk, glycerine ; in xerophthalmos, suturing of the lid margins, except of a small part opposite the centre of the cornea.

(*b*) In insufficient covering of the conjunctiva—ectropion, lagophthalmos. Treatment operative. (Cf. Ectropion, Lagophthalmos.)

2. General diseases :

(*a*) Night blindness—a triangular, dull, fatty-looking, dry, white spot on both sides of the cornea in the palpebral fissure.

Treatment. (Cf. Night blindness)—liver, darkness, improvement of general nutrition.

(*b*) Keratomalacia—begins as in (*a*), but spreads over the cornea ; it occurs only in children, and treatment is of no avail.

THE CORNEA

Abrasions of the Cornea. An erosion of the corneal epithelium from a slight injury—finger nail, straw, the removal of superficially situated foreign bodies, etc. It heals under a bandage in one or two days ; if there is much ciliary injection and hyperæmia of the iris, atropin or homatropin may be instilled once. It may recur, even after a considerable interval. The complaint which many people make of a sudden pain on opening the lids, followed by injection of the eye, or of awaking in the night with a sharp pain, may for the most part be referred to such recurrences. On examination no erosion may be found, or at most a localised unevenness of the epithelium. In these cases it is a good plan to lightly massage the cornea for a considerable time after the healing of the abrasion with boracic ointment (3 per cent. lanolini, vasel. *āā*). Quinine, too, internally 1·0 grm. (= 15 grains) daily in three doses is recommended (Hirsch).

Abscessus corneæ. (Cf. Ulcus serpens corneæ.)

Aplanatio corneæ. Flattening of the cornea from the cicatrisation of an ulcer, with much shrinking. There is always an anterior chamber, if only a very shallow one, and this distinguishes it from phthisis corneæ, in which in place of the cornea there is a flat cicatrised iris prolapse.

Treatment is of no avail. Aplanatio corneæ forms a contra-indication to iridectomy, which is technically impossible, on account of the simultaneous presence of cicatricial membranes behind the iris.

Tattooing for cosmetic purposes should only be undertaken when there are no signs of old severe iridocyclitis.

Calcareous Deposits in the Cornea occur in old degenerated cicatrices, and after lime burns owing to the inclusion of particles of lime. It is not to be mistaken for the milky white

opacity of the parenchyma remaining after deep lime burns, which depends upon the formation of a calcium albuminate. The treatment of the latter condition consists in bathing the cornea for half an hour two or three times a day with 2 to 12 per cent. ammonium chloride solution.

Treatment. Scraping of the cornea. When the deposits are in the superficial layers of the parenchyma they may be carefully touched with 5 per cent. hydrochloric acid solution after removing the epithelium; when the particles have been dissolved the acid should be neutralised with 5 per cent. soda solution.

Cicatrix corneæ is characterised by a grey, bluish grey, or white opacity of the cornea, superficial or deep in situation according to its origin, or involving the whole thickness of the cornea—after perforating ulcers or injuries. The surface is always lustrous and, according to the cause, may be even or uneven. New-formed vessels are very frequently present in young scars, but become more and more scanty in older ones; they may, however, reappear with fresh attacks of inflammation. The surface of the scar may be on the same level as the rest of the cornea, or be flattened—aplanatio corneæ (*q.v.*)—or prominent—ectasia corneæ (*q.v.*). Old cicatrices often show colloid and calcareous degeneration, and may then lead to atheromatous ulcers (Fuchs), (sequestrating scar keratitis Wintersteiner). Lead salts and lime may heal into scars.

Treatment:

(*a*) *Recent cicatrices.* First, cautious massage with vaseline or 3 per cent. iodoform or boracic ointment, to which ½ per cent. atropin may be added if hyperæmia of the iris is present. A portion of the ointment about the size of a hemp seed is placed in the conjunctival sac with a glass rod and then rubbed over the cornea through the closed lids with a circular movement and with light, gradually increasing pressure. Later, mild irritants: 1 to 5 per cent. precipitate ointment, with or without the addition of 5 per cent. dionin (cf. Abscessus siccus corneæ), insufflation of finely divided dry calomel (vapore parat.), vaporisation with an inhalation apparatus.

(*b*) *Old cicatrices* should be treated from the first with

irritants—3 to 10 per cent. yellow precipitate ointment, with or without dionin, calomel, tinc. opii; electrolysis; massage after thorough cocainisation with a knob-shaped kathode for about a minute, with $\frac{1}{5}$ to $\frac{1}{2}$ milliampère current, or application of a slightly concave electrode of about the size of half the corneal diameter, dipped in mercury in order to secure better contact; subconjunctival injections about 1cm from the limbus; 5 to 10 per cent. salt solution, 0·5 to 1·0 cc.—m.8 to m. 15 every second or third day, 10 per cent. iodipin, 0·3 to 0·5 cc.—m. 5 to m. 8; 5 to 10 per cent. dionin ointment or solution, or insufflations of solid dionin. When there is epithelial thickening and incrustation: scraping with a keratome.

All these applications must be used for weeks or months, improvement being tested every two or three weeks by taking the visual acuity.

N.B. Subconjunctival injections, dionin, and electrolysis are especially useful in deep scarring—keratitis interstitialis, etc.

Old cicatrices with colloid (atheromatous) degeneration are best left alone, since they very readily soften and ulcerate (atheromatous ulcer).

In old, dense, evascular cicatrices, especially after pannus, treatment with jequiritol may be used. (Cf. Trachoma, Pannus.)

Opacities left after lime burns, and caused by the formation of calcium albuminate, have been recently treated, with good results, by bathing them twice a day for half an hour with 2 per cent. gradually increased to 12 per cent. ammonium chloride solution (Guillery).

Ectatic cicatrices without incarceration of the iris: paracentesis, often repeated if necessary, followed by a pressure bandage; iridectomy, sclerotomy.

Scars with incarceration of the iris may be treated by iridectomy or, still better, by attempting to free the iris from the scar. The anterior chamber is opened with a keratome, and the adhesion divided with a blunt-pointed Graefe knife; the iris is then drawn out with a blunt hook or fine iris forceps and cut off. Good results are obtained by trephining the scar and implanting a piece of the cornea of a rabbit or

man, or by partially trephining, dividing the adherent iris, and replacing the piece of cornea.

To improve the vision in corneal cicatrices :

1. Optical iridectomy or extraocular iridotomy.

2. Tattooing—especially in faint central scars, which cause disturbance chiefly by diffusion of light.

Tattooing (*q.v.*) for cosmetic effect is suitable in firm smooth cicatrices. It is contra-indicated in ectatic scars, with or without incarceration of the iris, and in aplanatio corneæ with signs of old severe iridocyclitis.

Spontaneous clearing of old corneal scars often occurs, and is characterised by the appearance of transparent, often tuft-like or reticular lines within the opaque area.

Conical Cornea. *See* Keratoconus.

Descemetocele. *See* Keratocele.

Ectasia corneæ. Increased prominence of the cornea.

Causes. (*a*) *Inflammation without perforation* : keratectasia ex ulcere, e panno, e keratitide interstitiale.

Treatment. Chiefly prophylaxis by rest, laxatives, pressure bandage, repeated paracentesis of the cornea followed by a pressure bandage, or iridectomy if these measures fail. In quite small ectasiæ puncture with the point of the galvano-cautery and the continuous use of a pressure bandage. (Cf. Keratocele.)

When an extensive ectasia corneæ has already developed, an attempt may be made to obtain flattening by repeated localised cauterisation, or, better, by iridectomy or the excision of a strip and covering the wound with a conjunctival flap.

(*b*) *Inflammation with perforation : Staphyloma corneæ* or *anterior staphyloma* results from the ectatic cicatrisation of an iris prolapse ; it may be total or partial, and according to its form is called staph. conicum, globosum. Instead of the cornea or part of it there is a greyish white, cicatricial prominence of varying thickness.

Sequelæ : 1. Diminution of vision—in staph. totale only quantitative perception.

2. Trouble from the size of the prominence ; it may lead to ectropion and lagophthalmos.

3. Increased intraocular tension with complete blindness and bursting of the globe, in consequence of thinning in soft young prolapses; this is often followed by panophthalmitis.

Treatment. Prophylaxis: long continued use of a pressure bandage, repeated paracentesis and pressure bandage, section, excision of an oval piece.

When flat cicatrisation has been obtained the patient must not be allowed to pass out of observation too early, heavy work must be avoided, the bowels must be regulated, and cough must be combated; or a prophylactic iridectomy may be done.

Old staphylomata. 1. Partial: section followed by a pressure bandage—in recent thin-walled staphylomata; excision and suturing—in thick-walled staphylomata; iridectomy; trephining and transplantation of cornea, or partial temporary trephining and freeing of the adherent iris. (Cf. Cicatrix corneæ.)

2. Total: section and pressure bandage—in recent staphylomata—(*a*) linear through the middle of the staphyloma, (*b*) in the form of a flap; excision of a small oval piece from the summit of the staphyloma and suturing; excision of the whole staphyloma, followed by direct or purse-string suturing of the edges of the wound; enucleation—especially if there are also scleral ectasiæ.

C. Ectasia cornecæ of non-inflammatory origin.

1. Keratoconus (*q.v.*).

2. Keratoglobus (*q.v.*).

Facets of the Cornea. Shallow depressions of light grey colour and shiny surface; they consist of clean ulcers not yet quite filled up with cicatricial tissue, but covered with epithelium. They impair the visual acuity to a marked extent when in the pupillary area, in consequence of the altered, irregular corneal curvature.

Treatment. Massage. (Cf. Ulcus corneæ.)

Fistula corneæ appears as a small, dark, transparent depressed spot in a corneal cicatrix. The anterior chamber is very shallow or absent, and the intraocular tension lowered. It arises from the bursting of a soft recent cicatrix, which

closes temporarily, only to break open again. This may continue for a long time, until finally infection occurs, leading to severe damage or total destruction of the eye.

Treatment consists in obtaining consolidation of the cicatrix. This may be effected by repeated cauterisation of the edges of the fistula, if an anterior chamber is present; protective bandage, rest, laxatives. If this does not succeed, the fistula must be excised and the wound covered with conjunctiva, or the spot trephined and a piece of rabbit's or human cornea transplanted.

Foreign Bodies in the Cornea must be removed at once under cocain anæsthesia. A warning should here be given against the immoderate use of cocain, which is not only unnecessary but actually harmful to the corneal epithelium. For all operations on the globe it is sufficient to instil a *few* drops of a 3 to 5 per cent. solution three or four times at intervals of two or three minutes: great care must be taken that the eye is kept shut during the intervals. When there is much conjunctivitis and ciliary injection the blanching and slightly analgesic action of adrenalin may be used as an adjuvant.

Superficially situated foreign bodies may be removed after two instillations of cocain. The operation itself is performed with a lance-shaped needle or a small bevelled gouge. The lids are held apart with two fingers, and the globe is kept steady by exercising light pressure on it through the lids. The foreign body is raised from its bed with the instrument, care being taken not to cause unnecessary abrasion of the epithelium. In the case of particles of iron it is important to scrape away the rim of rust which forms round the foreign body from diffusion of the iron oxide. The use of atropin is superfluous, and causes dazzling which lasts longer than the process of healing. Afterwards a bandage is applied for one or two days. If the abrasion becomes infected, the ulcer is treated according to the usual rules.

Herpes corneæ. (Cf. Keratitis vesiculosa.)

Hypopyon Ulcer. (Cf. Keratitis—Ulcus serpens.)

Infiltratio corneæ. (Cf. Keratitis.) The first stage is a grey

or yellow opacity, usually not sharply limited, with a dull, sometimes raised surface.

Causes:

(*a*) After foreign bodies—abrasions. Situated in the palpebral fissure; the foreign body or a rust stain is often still visible in the infiltrate.

(*b*) In conjunctivitis phlyctenulosa:

1. Superficial and found in any part of the cornea.

2. Deep scrofulous infiltrate, usually central, yellowish grey, often prominent.

(*c*) In catarrh, concentric with the periphery of the cornea, but separated from it by a narrow normal zone; it may become sickle shaped by confluence.

(*d*) In herpes, quite superficial in groups, associated with vesicles.

(*e*) In lagophthalmos, usually in the lower half of the cornea, limited by a horizontal edge above.

(*f*) In keratitis neuroparalytica, commencing centrally, with a dry surface.

(*g*) In keratomalacia, associated with xerosis, diffused over the whole cornea; it quickly breaks down, and has a dry, fatty-looking surface.

(*h*) In diphtheria, and variola during the eruptive stage, usually central, not absolutely characteristic.

(*i*) In blennorrhœa, either peripheral under the chemotic conjunctiva, or as a central destruction of the corneal tissue.

Treatment. Cf. Keratitis, and the appropriate headings.

Injuries of the Cornea.

1. *Foreign bodies*, superficially situated.

Treatment: removal with a spud or needle; bandage; atropin only when much hyperæmia of the iris. (Cf. Foreign Bodies.)

2. *Abrasions of the epithelium* (*q.v.*). Concomitant conjunctivitis or dacryocystitis must be carefully noted, and if present, infection must be specially guarded against—extirpation of the lacrymal sac, antiseptic ointments. If already infected, see Infiltratio corneæ, Ulcus corneæ.

3. *Wounds of the substantia propria.* Usually incised or

lacerated wounds, with or without perforation, hyphæma, or hæmophthalmos ; in perforating wounds there may be prolapse of the iris or wounds of deeper parts—iris, lens, etc.

Treatment. Antisepsis—douching with sublimate, boracic acid, or potassium permanganate solution ; iodoform, airol, or xeroform in powder or ointment ; bandage ; rest.

Excision of prolapsed or incarcerated structures. In gaping wounds, covering with a bridge or flap of conjunctiva.

If the wound is already infected, iodoform, subconjunctival injections of sodium chloride, or hydrarg. perchlor., cauterisation of the margins of the wound, introduction of iodoform into the anterior chamber.

4. *Burns, Action of Caustics.* (Cf. Conjunctiva.) If quite superficial, they soon heal under a simple dressing ; in slight iritis it is sufficient to use atropin once only, or even homatropin.

If deep, healing takes place by casting off of the slough and cicatrisation ; perforation may occur, with its sequelæ. The treatment is that of an ulcer—atropin, hot fomentations, iodoform or airol ointment.

If adhesions form with the palpebral conjunctiva (cf. Symblepharon), they must be freed several times a day with a glass rod or probe ; or a piece of tinfoil or guttapercha tissue, smeared with boracic or iodoform ointment may be inserted.

Calcareous deposits (see this heading).

Perforation. (Cf. Ulcus Corneæ.)

5. *Opacities due to contusion.* (Cf. Opacities of the Cornea, Keratitis profunda.) They disappear spontaneously after a short time.

6. *Ruptures of the Cornea.* Very rare ; usually curved, or less commonly flaps, concentric with the limbus.

When gaping much, superficial corneal sutures may be applied, or they may be covered with conjunctiva.

In extensive lacerations or wounds : enucleation.

Keratitis. The treatment is determined by :

1. The *cause.* This is either local—foreign bodies, trichiasis, protruding infarcts of Meibomian glands, conj. catarrhalis, phlyctenulosa, blennorrhoica, diphtheritica, lagophthalmos,

herpes zoster, febrilis, or general—scrofula, rheumatism, arthritis, malaria, syphilis.

2. The *nature* of the inflammation, suppurative or non-suppurative; in the latter case the chief aim is to stop the spread of the ulceration. (Cf. Ulcus corneæ.)

Certain general rules for the treatment of keratitis may be given here, whilst special methods will be considered under the individual types. To hasten the absorption of suppurative and non-suppurative infiltrates moist heat is employed in the form of light compresses, dipped in water as hot as can be borne without pain, the patient being recumbent; they are to be applied for an hour, or in severe cases longer, three or four times a day. Water alone may be used, or in septic cases weak sublimate, 1 to 2 per cent. aluminium subacetate solution, or boracic acid lotion. During the application the temperature must be kept as constant as possible by frequently changing the compresses. Thermophores (Japanese muff-warmers) are unsuitable on account of their weight. Heat is further of excellent service in reducing the pain. Cocain should in general not be used, for on the one hand its action is only transitory, while on the other it has an injurious influence on the corneal epithelium; moreover, the dilatation which follows the temporary contraction of the vessels is harmful. Dionin, on the contrary, in powder or as a 5 per cent. ointment or 5 to 10 per cent. solution has an analgesic action, and at the same time promotes absorption by increasing the lymph circulation. Instillations of adrenalin, which is to be preferred to atrabilin (epinephrin, suprarenin) since it is more stable, have only a transitory analgesic effect by vaso-constriction. It should be mentioned that its action is chiefly on the superficial vessels, and is therefore slight when there is much ciliary injection. More effectual are pyramidon internally (0·3–0·5 grm. = gr. 5–8 per dose, up to 1·0 grm. = gr. 15 pro die) or aspirin (3·6 grm. = dr. 1 pro die); in the worst cases, small doses of morphia.

In order to protect the eye from light and dust, and to immobilise the lids, a protective bandage should be applied; it should have a layer of white gauze (Gamgee tissue) on the surface directed towards the globe, in order to prevent the

entrance of threads into the conjunctival sac. It must be worn until the infiltration or ulcer has become clean. When there is much discharge—catarrh, blennorrhœa—and in unruly patients, *e.g.*, little children, the bandage is contra-indicated, and should be replaced by dark glasses. So too, when there is much photophobia and blepharospasm, especially in phlyctenular keratitis, dark glasses should be used instead of a bandage.

The hyperæmia of the iris, which is a usual accompaniment, is combated by atropin in 1 per cent. solution. If the pupil dilates thoroughly with a single instillation, no more should be used, unless the inflammatory symptoms increase and the pupil therefore again becomes contracted. Especially in conjunctivitis phlyctenulosa atropin must not be employed too freely, since it increases the photophobia with its injurious consequences, owing to the mydriasis.

When the pupil does not dilate well, the use of atropin must be continued, or it may be combined with previous cocainisation, or applied in the dry form. A particle is placed in the conjunctival sac with a spud or Daviel's spoon, and the atropin is prevented from running into the nose and pharynx by pressure upon the lacrymal sac, the head being bent towards the shoulder of the same side. After about ten minutes the patient blows his nose forcibly once, in order to eject any tears which may have entered the nose. In small children great care should be used in the employment of atropin; the surgeon should himself apply it if possible, one or two drops sufficing; the tears which run over the cheeks should be prevented from entering the mouth, and the head should always be inclined towards the shoulder. If it must be left to the parents or attendants, $\frac{1}{4}$ to $\frac{1}{2}$ per cent. solution or $\frac{1}{2}$ per cent. ointment is ordered.

If atropin must be used for a considerable time the conjunctiva must be inspected from time to time for atropin catarrh, which necessitates the use of scopolamin instead. Atropin must also be given up if the patient complains of dryness and irritation in the throat—symptoms of poisoning.

If the methods already mentioned do not alone suffice to

cut short the keratitis, the chief means to adopt are iodoform, sublimate, cautery, paracentesis of the cornea, and scraping of the infiltrated tissue and covering it with conjunctiva (Kuhnt). As regards the choice of these the following points may be noticed :—

If, in spite of the use of moist heat and atropin, the suppurative process still spreads, either superficially or in depth, as shown by infiltration of the edges or floor, iodoform, xeroform, europhen, or airol should be insufflated in powder, or a 1 to 5 per cent. ointment applied to the ulcer with light massage. Good results are obtained with an atropin-sublimate ointment—hydrarg. perchlor. 0·025, atropin sulph. 0·1, vasel. alb. 20·0 ; or an airol-atropin ointment—airol 1·0, atropin sulph. 0·05, acid. boracic. 0·4, vasel. Amer. 10·0. If this is not followed by improvement subjunctival injections of 1 in 1000 sublimate are employed (cf. Introduction), and repeated daily until the inflammation ceases to progress. In the worst cases the advancing border should be cauterised with a pointed galvanocautery, or a paracentesis performed and repeated on several succeeding days if necessary, or the floor of the ulcer may be scraped and covered with a flap or bridge of conjunctiva. In ulcers quickly progressing towards the centre of the cornea and involving the pupillary area these general rules must be modified, since a much more energetic and rapid limitation of the process is imperative for optical reasons. Treatment with powder or ointment is combined with sublimate injections, and if the ulcer remains stationary is continued until it becomes clean. If, however, there is the least tendency to progression, cauterisation or paracentesis must be at once proceeded with.

If the purulent infiltration and ulceration are spreading chiefly in depth, the perforation of the cornea which threatens must, if possible, be prevented, best by puncture either with a keratome at the periphery or through the floor of the ulcer, followed by bandage and rest in bed. The floor of the ulcer may also be scraped and covered with conjunctiva in order to increase its powers of resistance. If there is no pain or fever the bandage should only be changed after three or

four days, when adhesion and commencing organisation have occurred.

In *non-suppurative forms of keratitis*, in which therefore no ulceration of the cornea takes place, moist applications, atropin, and subconjunctival injections of sublimate or salt solution are sufficient in the progressive stage. A local limitation of the process is often impossible, inasmuch as progression is in some forms inherent to the disease—keratitis interstitialis, annularis, profunda; while in other forms the whole cornea, or the greater part of it, is affected from the first—keratitis punctata superficialis et profunda. A third group on the other hand never, or only exceptionally, invades the centre of the cornea, irrespective of treatment—sclerosing keratitis, keratitis marginalis, etc.

If the keratitis has passed into the *regressive stage*, as shown by diminution of the injection and iritis, and above all, by return of the normal lustre to the affected part, treatment with ointments and gentle massage may be begun in order to promote the cicatrisation and regeneration. At first 3 per cent. boracic, 3–5–10 per cent. iodoform, xeroform, airol, europhen, or 5 per cent. dionin ointment may be used, gradually passing on to 1–3–5 per cent. yellow precipitate ointment, with or without the addition of 5 per cent. dionin.

It is a good general rule not to begin massage too soon, and to relinquish it on the slightest appearance of serious irritation.

On the treatment of cicatrices, see the corresponding heading.

N.B. In prescribing ointments it is of great importance that the drugs should be as finely divided as possible, especially in the case of yellow precipitate ointment.

The protean manifestations of keratitis make it essential, even in the narrow limits at our disposal, to differentiate each form, and to describe it somewhat exhaustively. On the one hand they are of diagnostic interest to the practitioner, on the other they demand special therapeutic measures according to their ætiology and symptoms, in addition to the general treatment already described.

I. Keratitis non-suppurativa.

A. Superficial Forms.

1. **Keratitis punctata superficialis** (Fuchs) sive subepithelialis sive maculosa.

2. **Keratitis vesiculosa, bullosa.**

Both occur in the form of scattered isolated spots, over which the surface of the cornea is slightly elevated ; there is at the same time much ciliary irritation, and often hyperæmia of the iris.

Whilst however in 1 the individual spots are very small, and only visible on oblique illumination and magnification with the loupe, as grey, rather sharply defined infiltrates, in 2 they consist of transparent or only slightly opaque epithelial vesicles. A further fundamental difference is to be found in the accompanying symptoms and course. *Keratitis punctata superficialis* begins with an acute catarrh, usually associated with catarrh of the mucous membranes of the respiratory tract, or influenza ; whilst this is in progress there suddenly occurs diminution of visual acuity with photophobia, ciliary injection and pain. A minute examination of the cornea—observation of the reflex, oblique illumination, loupe—furnishes the explanation. The infiltrates never break down, but become absorbed, either completely or leaving only fine, very delicate spots. Treatment is directed against the conjunctivitis : painting with 2 per cent. argent. nit., compresses of lead lotion, dark glasses ; later astringent collyria ; if much hyperæmia of the iris, atropin. After the acute stage massage of the cornea with 3 per cent. boracic ointment is indicated, followed by 1 to 5 per cent. yellow precipitate ointment for some weeks.

Keratitis vesiculosa and bullosa occur as :

(*a*) *Herpes febrilis* at the commencement of febrile diseases, especially of the respiratory organs, and often associated with herpes febrilis palpebræ, labialis, preputialis ; photophobia, pain, and ciliary injection are present, but the conjunctiva is not much involved.

(*b*) *Herpes zoster.* Simultaneous herpes zoster frontalis and palpebralis. (Cf. Lids.)

(*c*) *Keratitis bullosa.* In eyes with impaired nutrition—glaucoma absolutum, iridocyclitis—in the form of large epithelial vesicles. It also occurs as a consequence of the action of caustic substances on the cornea, after burns, after corneal operations, or as a sudden spontaneous eruption of vesicles, with much irritation and a tendency to recur. It may also be a form of keratitis phlyctenulosa.

The course is important in differentiating keratitis vesiculosa from keratitis punctata superficialis, since after the vesicles burst ulcers often form, and are indeed the rule in herpes zoster. These ulcers frequently assume a tree-like branched or asteroid form—*keratitis dendritica, stellata*—but seldom or never spread much in depth.

Treatment is antiphlogistic so long as the eruption of vesicles is present—atropin, dionin, hot compresses, bandage. As soon as ulcers have formed, they must be treated by sublimate or salt injections as well as other measures ; progress must be impeded by cauterisation of the infitrated margins, or touching them with a finely pointed stick of copper sulphate, and afterwards freely douching with distilled water or physiological salt solution. In the stage of regression massage with ointment (cf. Ulcus corneæ). In keratitis bullosa it is advantageous to remove the tops of the vesicles, or the epithelial shreds if they have already burst, after previously cocainising, and to touch the floor with 5 to 10 per cent. silver solution, absolute alcohol, copper stick, or 4 per cent. formalin solution. This may be done by means of a probe, or wooden or glass rod, wrapped round with cotton wool, and dipped in the solution. It is followed by free douching with water or salt solution, and a bandage. Sometimes an iridectomy produces the desired result. In incurable cases only enucleation remains.

In herpes febrilis and zoster general treatment must naturally not be omitted. (Cf. Herpes zoster of the Lids.)

3. **Keratitis filamentosa.**

4. **Keratitis marginalis superficialis.**

Both are of merely diagnostic interest. The first disappears

of itself, the second requires the general treatment of keratitis already described.

B. Deep Forms.

1. **Keratitis interstitialis.** An infiltrate situated in the middle and deeper layers of the corneal stroma, and consisting of very minute spots and lines. It commences either at the margin or in the middle of the cornea. In the former case it is combined with much swelling of the limbus ("like an epaulette") and the formation of deep-seated nodules—keratitis interstitialis vasculosa; in the latter, formation of vessels is absent or scanty, but it gradually spreads towards the periphery—keratitis interstitialis evasculosa.

Retrogression begins from the periphery of the cornea, the centre long remaining opaque; it leaves behind cicatrices which are often capable of clearing up to marked extent. Ectasia and aplanatio corneæ may occur. Keratitis interstitialis vasculosa may not spread over the whole cornea, the process ceasing before this takes place.

There is always considerable participation of the iris, ciliary body (shown by precipitates—"keratitis punctata"—or even hypopyon), and the anterior part of the choroid (anterior choroiditis, vitreous opacities). It seldom remains unilateral, and scarcely ever recurs. Corneal ulceration is quite exceptional. The course is chronic, lasting at least 6 to 8 weeks.

Ætiology. 1. Congenital syphilis. Chief symptoms: flattened upper jaw and bridge of nose, frequently ozæna, deformities of the teeth—notches in the incisors, etc. (Hutchinson's teeth), defects in the enamel, early caries—scars of rhagades at the angles of the mouth; deafness; hard, swollen, painless glands, arranged in chains behind the sterno-mastoid; nodules in the long bones; history of frequent abortion and miscarriage in the family. The disease generally occurs from the sixth to the twenty-fifth year, seldom later.

2. Acquired syphilis, tubercle, scrofula; in some cases uncertain.

Treatment. General: antisyphilitic, in the form of sublimate pills, especially in small children—0·001 grm. ($\frac{1}{60}$ grain) per

pill with kaolin ; three pills a day, increased one a day until ten are being given. These should be taken before meals, and after a week the dose should be decreased to three pills a day. Or inunctions may be employed—1·5 to 4 grms. (dr. ½ to dr. 1) daily, according to the age and constitution of the patient ; five applications are made, and after a pause another five, and so on, until this has been done 6 to 8 times. Or intramuscular injections of a 1 to 5 per cent. solution, repeated every 2 to 6 days according to the strength (cf. Introduction). The action of the mercury on the gums must be watched.

In the regressive stage, mercury is to be replaced by iodides—3 to 10 grms. (dr. 1 to dr. 3) sodium iodide daily, syr. ferri iodidi dr. 3 daily, iodine-containing mineral waters. This treatment must be continued for some weeks.

In tuberculous and scrofulous cases : treatment of the fundamental condition, and general tonic treatment.

Local : in the progressive stage energetic treatment with atropin, moist heat (hot fomentations for one hour three times daily), dionin—5 to 10 per cent. solution or ointment, or insufflation once or twice daily, dark glasses.

In the cicatrising stage, the methods already given for the treatment of keratitis and for the clearing up of cicatrices—vaporisation, ointments, subconjunctival injections of salt solution or iodipin.

It may be mentioned here again that the course is tedious, and that in spite of proper treatment the disease often progresses until it has involved the whole cornea. This, however, is no reason for interrupting the treatment, or considering it faulty, if the case seems to be getting worse. Experience shows that cases of vascular interstitial keratitis which look quite desperate often undergo remarkable improvement, and leave behind very slight traces. Treatment should, therefore, be continued for weeks and months, especially in the regressive stage.

When accompanied by rise of tension and keratectasia, paracentesis and a pressure bandage are indicated, or, if these have no permanent result, iridectomy or sclerotomy.

2. **Keratitis profunda**, occasionally in adults, has a deep

lying grey infiltration, resolved with the loupe into fine points and lines. Its course is chronic (4 to 8 weeks), with but slight signs of iritis or irritation of the eye, and little or no development of vessels. It may end with complete clearing of the cornea.

Causes. Cold (Keratitis rheumatica, Arlt)—usually with somewhat marked irritation, pain, and photophobia. Malaria—indolent, very tedious course. Traumata, especially contusions—rapid course, *restitutio ad integrum.*

Treatment. General: of the primary disease. Local: atropin, bandage or dark glasses, moist heat; later clearing agents. (Cf. Cicatrix corneæ.)

3. **Keratitis annularis.** A variety of interstitial keratitis, in which individual spots of infiltration become confluent, forming a grey ring in the centre of the cornea.

Treatment. See Keratitis interstitialis.

4. **Keratitis disciformis** (Fuchs). In middle-aged people, often after a superficial abrasion—trauma, bursting of herpes vesicles, etc.,—a central, round, sharply circumscribed infiltration of the corneal stroma occurs, over which the surface is dull and insensitive. Irritation of the iris is moderate; the course is chronic, and a distinct opacity is left behind.

Treatment. Atropin, hot fomentations, subconjunctival sublimate injections, paracentesis; if a dense opacity is already present, the surface may be rubbed with absolute alcohol, or the galvano-cautery applied. Later, in the regressive stage: clearing agents. (Cf. Cicatrix corneæ.)

5. **Keratitis punctata profunda.** Deep-lying, scattered points of infiltration in iridocyclitis from acquired syphilis.

Treatment. Antisyphilitic; local, that of keratitis (*q.v.*) and iridocyclitis (*q.v.*).

6. **Sclerosing Keratitis.** An accompaniment of deep scleritis in the neighbourhood of the cornea. It occurs in the form of deep white or yellowish grey sectors of opacity at the extreme periphery of the cornea, and these may amount to complete loss of transparency, giving the cornea the appearance of sclerotic. More rarely it is in the form of irregular spots, distant from the periphery. The formation of vessels

is very slight, and the opacity cannot be made to clear much; there is also a great tendency to recurrent attacks.

Treatment. That of scleritis. In the cicatricial stage an attempt should be made to obtain clearing by the long continued use of dionin and subconjunctival injection of salt solution or iodipin.

7. **Keratitis commencing at the posterior surface of the Cornea.** It arises from the deposit of exudates—hypopyon, precipitates ("k.p.")—the presence of foreign bodies, or the application of the iris to the posterior surface—iris bombé, cysts or tumours of the iris. It occurs as a very deep, grey opacity, occasionally showing a few vessels; it does not disappear either spontaneously or as the result of any treatment.

As a prophylactic measure the causes should be eliminated if possible—evacuation of extensive hypopyon, extirpation of of cysts or tumours of the iris.

II. Keratitis Suppurativa.

This is characterised, as already mentioned, by destruction of the corneal tissue—*i.e.* the formation of ulcers. The general *treatment of a corneal ulcer* may therefore be first considered.

This must be in the first place causal—removal of foreign bodies, misplaced cilia, infarcts of the Meibomian glands, and warts of the lid margins; treatment of catarrh, dacryocystitis, stricture of the lacrymal duct, diphtheria, blennorrhœa, trachoma, etc. In addition attention should be paid to the following:—

1. Prevention of extension superficially, especially towards the pupillary area.

2. Prevention of extension in depth—perforation.

3. After the occurrence of perforation, combating its injurious consequences.

4. After the end of the progressive stage, striving to obtain as clear a cornea as possible, and flat consolidation of the scar.

ad 1. If the ulcer does not soon begin to heal, or at least cease to spread, on the application of hot fomentations and instillations of atropin (1 per cent. solution or ½ per cent. ointment, or solid atropin with or without cocain once or twice

daily) these measures must be reinforced by subconjunctival injections of 1 in 1000 sublimate or 2 to 10 per cent. salt solution (cf. Introduction), or still better by cauterisation of the advancing edge with the galvanocautery. The last measure is especially to be preferred when the ulcer is spreading towards the pupillary area. Paracentesis of the cornea, with daily opening of the wound under cocain, is a potent means of combating the spread. A protective bandage must be used except in unruly children * and when there is much discharge.

Small ulcers, with only slight infiltration of the floor and edges, and therefore with little or no tendency to spread, may be massaged with atropin-sublimate ointment, or atropin-airol, or atropin-iodoform, or xeroform, dionin, or europhen ointment (see formulæ in Appendix). In superficial phlyctenular ulcers even yellow precipitate ointment is sometimes well borne from the first, but should be used cautiously, on account of its irritative properties.

When there is much pain and iritis, dionin may be recommended in solution, ointment, or powder.

℞ Hydrarg. cyanidi . . . . . 0·01
sive Hydrarg. perchlor. . . . . 0·005
Cocain. hydrochlor. . . . . 0·1
Dionini . . . . . 0·3—0·5
Aq. dest. . . . . 10·0
S. To be instilled several times a day.

℞ Dionini . . . . . 0·1
Sodii bicarb. . . . . 0·2
Cocaini . . . . . 0·1
Aq. dest. . . . . 10·0
S. To be instilled five or six times a day.

℞ Dionini . . . . . 0·1
Cocaini hydrochlor. . . . . 0·1
Aq. dest. . . . . 0·05—0·1
S. To be instilled three times a day.

* In order to prevent children from touching their bandages a straight splint may be applied to the front of the arm, reaching a little beyond the elbow, so as to prevent flexion.—Trs.

℞ Dionini . . . . . 0·25—0·5
Iodoform. . . . . 0·3—0·5
sive Airol. . . . . 0·3—0·5
sive Xeroform. . . . . 0·5
sive Hydrarg. perchlor. . . . 0·005—0·01
sive Atrop. sulph. . . . . 0·05—0·1
Vasel. alb. . . . . 10·0
S. The cornea to be massaged once or twice a day.

℞ Dionini . . . . . 0·25
Ol. theobrom. . . . . 1·0
Ft. massa ad bacillos 10
S. One or more rods to be inserted daily into the conjunctival sac.

N.B. When catarrh, blennorrhœa, or trachoma are also present, the lids may be painted with 2 per cent. argent. nit., even during the progressive stage. Copper in trachoma, and lead in catarrh, as collyria, ointments, or compresses must never be used, on account of the irritation and danger of deposits.

ad 2. If there is danger of perforation, as shown by deep loss of substance, with steep edges and purulent or bulging floor, rest in bed should be ordered as a prophylactic measure, and laxatives given. If these are not sufficient a paracentesis should be performed and the aqueous drawn off ; an incision is made with a keratome in the outer or inner lower quadrant of the cornea, and the peripheral lip of the wound pressed upon with a Daviel's spoon, or the floor of the ulcer itself may be punctured, best with a thermocautery. In central ulcers the iris must, if possible, be drawn away from the area in which perforation threatens, by energetically dilating the pupil with solid atropin and cocain, assisted by dionin or adrenalin (cf. also Keratocele). Cautious scraping of the floor of the ulcer with a sharp spoon, and covering it with conjunctiva gives excellent results in many cases.

ad 3. If perforation has taken place our therapeutic measures vary according to its size and position. If it is in the pupillary area, prolapse of the iris is not to be feared, and rest in bed, bandage, and atropin suffice for treatment. At the

same time all forced expiration must be avoided—blowing the nose, coughing, sneezing, and straining at stool. If the perforation is over the iris, but very small, only adhesion of the iris with the cornea can occur; this may become detached when the chamber is restored, or after cicatrisation may be drawn out into a thin thread. These cases involve no ultimate danger to the eye. In larger perforations, a prolapse of the iris must be excised after freeing it all round from the cornea with a conical sound. The resulting coloboma must have absolutely free pillars on both sides. The wound is then dusted with iodoform, xeroform, or airol, sterilised atropin instilled, and a dressing applied, which must be well fixed in children and unruly patients. If the prolapse is very large excision is not to be recommended, but flat cicatrisation must be aimed at by the prolonged use of a pressure bandage; if the scar is already beginning to bulge repeated paracentesis should be performed, or a small piece excised. The same treatment holds good for old ectatic prolapses, the excision of which is no longer technically possible.

ad 4. The measures to be adopted for clearing the cicatrices have been described under cicatrix corneæ. Irritating ointments, such as yellow precipitate, should not be used too early, but iodoform, sublimate, xeroform, airol, etc., should be employed, with or without the addition of atropin and dionin.

The most important form of ulcus corneæ is:

Ulcus serpens (Hypopyon Ulcer, Hypopyon Keratitis, Abscessus corneæ), in consequence of its tendency to rapid progression and the danger of perforation of the cornea.

At its commencement it is characterised by its central position, rounded shape, and early association with hypopyon.

The infective agent is usually the pneumococcus, often originating in a blennorrhœa of the lacrymal sac, which is frequently latent. The lacrymal passages must therefore in every case be carefully examined; usually it is enough to press upon the sac, when mucus or pus will regurgitate, but in other cases the duct must be probed.

Treatment. The source of infection must above all be dealt with, best by extirpation of the lacrymal sac, or by opening

and destroying it (cf. Blennorrhœa of the Lacrymal Sac). Locally : diligent use of atropin and hot fomentations, and subconjunctival injections of sublimate or salt solution (cf. Introduction). If in the next few days the ulcer improves, or at least does not progress, and if the hypopyon does not increase, this treatment is continued until cicatrisation occurs. If there is the slightest spread, as shown by a yellow infiltrated border, deepening of the floor, or increase of the hypopyon, the progressive edge must be cauterised with the thermocautery. In extensive hypopyon, reaching as high as the pupil, paracentesis should be performed to evacuate it. When the ulceration is already extensive it may be brought to a standstill, and the hypopyon simultaneously evacuated, by dividing it from behind forwards with a Græfe knife (Sæmisch section) in a horizontal direction, where it is broadest. The wound should be opened daily with a spatula under cocain, and the aqueous drawn off. Bandage.

In the cicatricial stage : at first sublimate-atropin or 3 per cent. iodoform ointment, then the stronger irritants, in order to obtain clearing. (Cf. Cicatrix corneæ.)

Varieties of ulcus serpens are :

1. **Keratomycosis aspergillina.** It consists of an invasion of the cornea with a fungus, especially aspergillus fumigatus. A white, dry, sharply circumscribed area is formed, like an ulcus serpens, but whiter in colour, and the round central infiltrate is drier and more felt-like ; moreover the irritation is less, the progression slower, and perforation rare. It begins in the centre and spreads towards the periphery ; the affected parts necrose, with the formation of a sequestrum.

Treatment. Atropin, hot fomentations, removal of the felt-work of fungus, and cauterisation of the floor and edge. Later, measures to clear up the cicatrix.

2. **Abscessus siccus corneæ.** Purulent infiltration in the substantia propria, which does not lead to solution of the tissue or break through externally. A rounded yellow-grey opacity in the middle layers of the cornea, usually with sharp edges ; the surface over it is dull, and sometimes slightly depressed. Moderate hyperæmia of the iris and ciliary body,

rarely hypopyon. Course tedious. Heals leaving behind a deep opacity, which, if extensive, may be associated with development of vessels and flattening of the cornea.

Treatment. When recent and progressive: atropin, subconjunctival injections of sublimate; the latter must be repeated daily until the process stops or improves, and are only to be discontinued if infiltrations appear at the points of injection. Hot fomentations are to be applied to the eye of the recumbent patient; they should be composed of a few layers of lint dipped in hot water, but must not be too heavy. They should be used for an hour three or four times daily, being frequently changed, so that the eye may be kept at an even temperature.

When there is great congestion of the conjunctiva and iris, four to six leeches should be applied to the temple. The eye must be protected from light—occlusive bandage, dark glasses.

When the inflammation has run its course—globe pale, surface of the cornea lustrous, iris normal—measures are taken to clear the cicatrix. (Cf. Cicatrix corneæ.)

Old cicatrices after abscessus siccus may be tattooed for cosmetic reasons, and to diminish the diffusion of light which they cause. (Cf. Tattooing.)

Ring Abscess of the Cornea (Peripheral Annular Infiltration). The result of infection of incised wounds of the cornea, especially after injuries and operations, causing a peripheral annular purulent infiltration of the stroma. It is accompanied by œdema of the lids, chemosis, hypopyon, iridocyclitis, choroiditis suppurativa; it spreads finally also over the centre of the cornea, and leads almost always to its total destruction or to panophthalmitis, resulting in staphyloma, phthisis corneæ, or phthisis bulbi respectively.

Treatment. Cauterisation of the infected margins of the wound, subconjunctival sublimate injections, opening of the wound, and introduction of iodoform into the anterior chamber, atropin, hot fomentations with dilute sublimate or aluminium subacetate. Enucleation is usually necessary later.

Other important forms of purulent ulceration of the cornea are:

Keratitis fascicularis. A peculiar form of conjunctivitis

phlyctenulosa, with superficial scrofulous or eczematous infiltration of the cornea. It appears as a radially directed grey furrow, in which superficial vessels run ; the central end consists of a grey infiltrate, sometimes a little prominent. It is caused by the spread of infiltration towards the centre of the cornea, with healing at the periphery.

Treatment. Massage with iodoform, xeroform, or atropin-sublimate ointment, later yellow precipitate ointment. When progressing towards the centre of the cornea, cauterisation of the edge or scraping with a sharp spoon, and touching with alcohol, tincture of iodine or formalin solution, followed by irrigation with salt solution or water, or covering with a conjunctival flap.

Keratitis e lagophthalmo. Causes ; insufficient covering of the cornea by the lids, as the result of which it becomes dry ; hence due to (1) mechanical causes—shortness of the lids, proptosis or enlargement of the globe : (2) facial paralysis.

In agreement with this ætiology it usually affects the lower segment of the cornea, but in ectropion of the upper lid may be situated elsewhere. It leaves behind permanent opacities, and if the cause persists may lead to panophthalmitis and destruction of the eye. Treatment must therefore be above all prophylactic by securing adequate closure of the lids. This is effected in transitory lagophthalmos, *e.g.*, rheumatic facial paralysis, by passively closing the lids and securing them with strips of court plaster, especially at night ; less suitably the eye may be covered with a dressing smeared with vaseline or boracic ointment, in order to prevent drying. In permanent lagophthalmos, cure by operation ; in ectropion, plastic operation after first temporarily suturing the lid margins together ; in incurable facial paralysis or Graves's disease, tarsorrhaphy, Szymanowski's operation ; in lagophthalmos from enlargement of the globe or orbital contents, enucleation, extirpation of the orbital tumour, exenteration of the orbit.

For the treatment of the keratitis itself, see Keratitis.

Keratomalacia. A rapid destruction of the cornea, usually bilateral, occurring in poorly nourished children—congenital syphilis, after enteritis, measles, scarlatina, typhoid ; it is

associated with dryness of the conjunctiva—xerosis—in the form of a triangular, dry, white, foamy fleck on both sides of the cornea. Symptoms of irritation, especially pain and lacrymation, are slight, and it soon leads to perforation, resulting in phthisis or atrophia bulbi. In rare cases some cornea is left, with or without prolapse of the iris. The children usually soon die from cachexia or bronchopneumonia.

Treatment. Improvement of the general condition of the child. Locally : moist heat, atropin, and when the lids are not properly closed, owing to apathy, a dressing smeared with ointment.

Keratitis neuroparalytica. As a result of paralysis of the trigeminal the cornea becomes dull and opaque, the epithelium is gradually thrown off completely, hypopyon occurs, and purulent destruction of the cornea, beginning in the middle. It ends in healing with a dense scar, or perforation with incarceration of the iris. Characteristic points are the slight pain and lacrymation in spite of the deep ciliary injection. Prognosis is unfavourable on account of the trophic disturbance.

Treatment. Bandage, hot fomentations, atropin, galvanisation of the trigeminal, injections of strychnine in the temple (½ to 1 per cent. solution of strychnine nitrate, 0·5 to 1·0 cc.—m. 8 to m. 15 two or three times a week).

Ulcus rodens corneæ (Mooren). A superficial ulcer, commencing at the corneal margin, with central grey, often irregular, undermined edge, accompanied by marked irritation. After it has become clean and vascular recurrences take place until it has spread over the whole cornea. It leaves behind a permanent opacity, but never perforates.

Treatment holds out little prospect of permanent success. Cauterisation, removal of the undermined and infiltrated edge, painting with absolute alcohol and subsequent irrigation with water.

Keratitis dendritica, stellata. (Cf. Keratitis vesiculosa.)

Keratocele (Descemetocele). A transparent, light grey vesicle, in the floor of an ulcer, consisting of Descemet's membrane only.

Treatment. Prevention of perforation of the ulcer by rest,

laxatives, and a pressure bandage. If this is insufficient, paracentesis repeated if necessary, followed by bandage and rest in bed ; or the keratocele itself may be punctured with a needle or fine galvanocautery, and a pressure bandage subsequently used for a long time.

Keratoconus, Conical Cornea. Develops gradually and without inflammation. *Symptoms* : Disturbance of vision from myopia and myopic astigmatism, deep anterior chamber ; on looking at the cornea obliquely its conical form may be directly observed. It is a rare affection of unknown cause, generally bilateral.

Treatment. In recent cases prophylaxis may be attempted by avoidance of over-use of the eyes and instillations of myotics—pilocarpin, eserin. In fully developed cases flattening of the cornea is aimed at by producing a resistant cicatrix in place of the thin yielding apex,—repeated cauterisation and puncture. If this is insufficient a small piece of the apex may be excised, and an iridectomy performed to reduce the intraocular tension. If flattening has been attained an optical iridectomy, down and in, should usually be undertaken, if this has not already been done, since the scar of the cauterisation or excision lies in the pupillary area. Mere correction by concave glasses, with or without cylinders, gives only moderate improvement of the vision.

Keratoglobus. Part of a general enlargement of the globe. (Cf. Hydrophthalmos, Buphthalmos.)

Treatment. Attempt to obtain flattening by iridectomy, repeated if necessary ; the result is not usually good.

Lead Deposits in the Cornea arise from the use of lead-containing lotions or ointments in recent infiltrates and ulcers. They appear as white, curdy deposits in the superficial layers of corneal cicatrices, consisting of fine points.

Treatment. Scraping off.

Leucoma adhærens.

Treatment. Small leucomata—*i.e.*, cicatrised prolapses of the iris—especially after keratitis phlyctenulosa, require no treatment if not ectatic. As a prophylactic measure, however, against possible rise of tension and atheromatous degeneration

of the scar, the anterior synechia may be divided. This is performed either by excision of the iris on both sides of the adhesion, or by trephining the leucoma and transplantation of cornea, or finally by partial trephining, excision of the adherent iris, and reposition of the flap. In small ectatic leucomata flat cicatrisation must be aimed at, either by iridectomy on both sides of the anterior synechia, followed by long continued use of a pressure bandage, or by trephining and transplantation.

In extensive or total leucomata, if there is much irritation or rise of tension, iridectomy or sclerotomy should be performed if technically possible ; otherwise the ectatic cicatrix should be partially or completely excised. Enucleation may be necessary (cf. Ectasia and Staphyloma corneæ). Cosmetic tattooing may be undertaken when there are no symptoms of irritation.

Myocephalon. An old, cicatrised iris prolapse in the periphery of the cornea, usually after phlyctenular ulcers, appearing as a slate grey to black round spot, surrounded by a white zone of cicatrisation.

Treatment. Not imperative, but in order to prevent possible rise of tension, the spot may be trephined and the adherent iris freed.

Opacities of the Cornea. Every inflammation or injury of the cornea which extends below the epithelium causes an opacity when recent, and a scar when old. In order to differentiate between them the lustre of the corneal surface over the opacity must be observed. If the surface is shiny it is a cicatrix ; if it is dull, stippled, or like shagreen, inflammation is present, and, according to whether the surface is even or excavated, it is an infiltrate or an ulcer. For the treatment of these conditions see under the corresponding headings.

There are also certain opacities not of inflammatory origin, viz. :—

1. *Arcus senilis* (Gerontoxon), and the similar condition occurring in young people—

2. *Embryotoxon.* Neither is amenable to treatment.

3. *Band-shaped Opacity.* This requires treatment only in

those rare cases in which the affected eye is otherwise normal. The part covering the pupillary area must be scraped and a bandage applied until the epithelium has regenerated.

4. *Tension Opacity*, caused by increase of intraocular pressure ; it disappears after restoration of the normal tension by paracentesis, iridectomy, etc.

5. *Contusion Opacity*, after blows upon the globe ; it disappears spontaneously in a short time.

6. *Striate Opacity*, after incised wounds of the cornea, especially cataract operations, in the form of grey parallel lines, perpendicular to the direction of the wound ; it soon disappears without treatment (traumatic striate opacity). Folding of the cornea may also occur after the prolonged use of a pressure bandage ; on leaving off the bandage this, too, quickly disappears (Rhytidosis corneæ).

7. *Nodular Opacity* (Groenouw, Fuchs) requires long continued massage with 5 per cent. yellow precipitate ointment, with or without the addition of 5 per cent. dionin, or the cornea may be scraped.

8. After *Hæmorrhage into the Cornea*, a brown or greenish-grey opacity remains, for which treatment is of no avail.

9. In certain employments—in nitronaphthalin or aniline workers—an opacity of the cornea occasionally occurs from chemical causes; the work should be given up, and massage used.

Pannus. A superficial form of keratitis non-suppurativa. It is either a complication of a trachomatous or phlyctenular conjunctivitis (Pannus trachomatosus, phlyctenulosus) or arises from long-continued mechanical irritation of the corneal surface—*e.g.*, trichiasis (Pannus traumaticus).

Treatment. That of the primary disease. For recent pannus—gelatinous, vascular opacity : massage with 1 to 10 per cent. yellow precipitate ointment, or copper sulphate ointment ; in old, thick, gelatinous trachomatous pannus, the pannus itself may be cautiously touched with the alum or copper sulphate stick, or it may be directly massaged with the Daviel's spoon after cocainising. Peritomy or periectomy may be performed—*i.e.*, the separation of the conjunctiva from the limbus, with or without the excision of a narrow strip.

Cicatricial pannus: 5 to 10 per cent. yellow precipitate ointment, with or without the addition of 5 per cent. dionin; electrolysis (cf. Cicatrix corneæ). In old evascular pannus, extending over the whole cornea and without conjunctivitis, an attempt may be made to obtain clearing with jequirity. By the older method this was performed by energetically painting the conjunctiva and cornea with 3 to 5 per cent. infusion of jequirity which must be freshly prepared daily.

℞ Semin. jequirity . . . . . 3·0–5·0
Contunde exactissime; macera p. horas xxiv. c.
aq. frigida ad colat. . . . . 100·0

This is continued until the tarsal conjunctiva is covered with a grey croupous or diphtheritic membrane—jequirity ophthalmia. The inflammation is then allowed to subside under simple cleansing of the eye.

More recently this treatment has been replaced by another, capable of more exact dosage. The alkaloid of the jequirity bean, abrin, is prepared in four grades of strength with 50 per cent. glycerine, and this so-called jequiritol is instilled directly into the conjunctival sac. (The complete equipment, with instructions for use, may be obtained from the firm of E. Merck, Darmstadt.)

Perforation of the Cornea. Symptoms of perforation from a wound or ulcer are absence of the anterior chamber, lowering of the intraocular tension, and, if peripheral, incarceration or prolapse of the iris.

Sequelæ of perforation of an ulcer: corneal fistula; prolapse of the iris; infection of the interior of the eye, panophthalmitis; dislocation of the lens from its advance, and stretching of the zonule of Zinn after flowing off of the aqueous; intraocular hæmorrhage, especially in glaucoma, resulting from the sudden fall of tension.

Treatment. See the appropriate headings. In general, bandage, rest in bed, purgatives; in wounds or progressive ulcers with much purulent infiltration, antiseptic treatment—iodoform powder, subconjunctival sublimate injections, cauterisation. Excision of prolapsed iris.

Peripheral Sclerosis of the Cornea (Fuchs). Very rare. An atrophy of the cornea, occurring spontaneously and without inflammation, and forming a gutter at the corneal margin. It is found in old people, and lies peripheral to the arcus senilis which may be present at the same time. In some cases the thinned portion may become ectatic, so that a protrusion takes the place of the gutter.

Treatment is of little avail; at most, a small strip may be excised from the ectatic zone, and the wound covered with conjunctiva.

Phthisis corneæ. The final result of suppurative destruction of the cornea and the flat cicatrisation of a total prolapse of the iris.

Treatment, only when the scar is ectatic. (Cf. Ectasia corneæ.)

Staphyloma corneæ. (Cf. Ectasia corneæ.)

Tattooing of the Cornea is carried out either with a bundle of needles or with a hollow needle. The colouring material is finest Chinese ink, which must be sterilised by dry heat (160° C.) before use; it is then rubbed down into a thick paste with a few drops of sterile water, or is dissolved by keeping at 98° C. for 15 minutes. Recently the pigment of the ciliary body of the ox has been employed (Nieden), but it is very expensive.

After thorough cocainisation the instrument smeared with the ink is thrust obliquely about ½ mm. deep; according to the degree of saturation of the colour required the punctures are placed more or less closely together. If it is desired to mark out a black pupil in a scar, a central area corresponding in size with the pupil of the other eye is scraped so as to remove the epithelium and the superficial layers of the cicatrix, or more conveniently is trephined (Fröhlich). The ink is then rubbed in with a Daviel's spoon, the conjunctival sac cleansed from particles, and a bandage applied. If ciliary injection appears during the next few days, atropin is instilled.

Several sittings are required for extensive tattooings. After some time the pigment must often be renewed, as it is partially thrown off.

Tumours of the Cornea. Primary tumours are very rare—myxoma, sarcoma, fibroma ; dermoid, which is congenital, is situated partly in the conjunctiva. (Cf. Dermoid of the Conjunctiva.)

Secondary tumours—carcinoma, sarcoma of the conjunctiva (usually of the limbus), teratoma.

Treatment. Extirpation, after which the exposed surface must be thoroughly cauterised. In extensive, deep-seated (especially secondary) tumours, enucleation is indicated.

Ulcers of the Cornea. (Cf. Keratitis.)

GLAUCOMA

Of all diseases of the eye glaucoma is the subject of most mistakes in diagnosis by the inexperienced; and this is the more serious, because the eye, instead of being saved, becomes completely and incurably blind. While it is not the function of this book to enter minutely into points of diagnosis, yet it seems necessary to mention the chief symptoms, and especially those which experience shows to be most important for differential diagnosis, since only a prompt and rational treatment can save the patient from lasting and irreparable harm.

Glaucoma may be *primary* or *secondary*, and the former again may occur either in an *acute or chronic inflammatory form* or as *Gl. simplex.*

1. *Glaucoma inflammatorium acutum.* This takes the form of attacks, in the intervals of which the appearance of the eye is either normal or as in *Gl. chronicum.*

Subjective Symptoms. Sudden and considerable diminution of visual acuity, amounting even to blindness, with severe neuralgic pain, radiating from the eye towards the temple and back of the head: it may resemble severe migraine with malaise, vomiting, and constitutional disturbance, so that it may be mistaken for biliousness, meningitis, or influenza. The disturbance of vision is described as a diffuse mist, usually associated with seeing rainbow-coloured rings round lights.

Objective Symptoms. Diffuse dulness and smoky opacity of the cornea, dusky ciliary and conjunctival injection, shallow anterior chamber, dilated, fixed or very sluggish pupil, and increased intraocular tension. In severe cases there is often œdema of the lids and conjunctiva, and blepharospasm. Cupping of the disc may in rare cases develop even in a first attack. During the attack ophthalmoscopic examination is difficult or impossible.

Testing the intraocular pressure is particularly important, and must always be done on both eyes for the sake of comparison. This is carried out as follows : The eyes are closed, and the index fingers of both hands are placed upon the upper lid and alternately pressed against the globe, as in testing for fluctuation. The tension of the normal eye is not constant but varies within somewhat wide limits, yet it may be dimpled without the use of force or the production of pain, the other finger being at the same time appreciably raised ; when the tension is increased on the other hand, the globe can only be dimpled to a slighter degree with more force, or not at all. If there is much blepharospasm or squeezing together of the lids, especially in children, the estimation of tension is extremely difficult or impossible : hence an anæsthetic may be necessary. When œdema of the lids is present accurate judgment is rendered difficult by the soft consistence and increase in thickness ; in this case the fluid must first be displaced from the subcutaneous tissues by slowly increasing pressure with the fingers, until the globe is plainly felt through the lid.

2. *Glaucoma inflammatorium chronicum.* The same symptoms as in 1, but in less degree, the constitutional symptoms in especial being not so marked. The eyeball shows slighter inflammatory symptoms ; very noticeable are the overfilled and abnormally visible anterior ciliary veins, which sink into the sclera at the points of insertion of the recti. Here, too, there are sometimes symptoms of iritis—a few synechiæ, swelling, slight cloudiness of the aqueous.

Ophthalmoscopically : Excavation of the disc, more plainly visible than in 1. on account of its greater development and the less marked corneal opacity.

When the eye is free from irritation the following signs are pathognomonic : abnormal dilatation of the pupil, with very sluggish or absent reaction, increase of tension, and in old cases atrophy of the iris (Habitus glaucomatosus).

When there is complete blindness, the condition is called *Glaucoma absolutum* : anterior ciliary veins much dilated, cornea clear, lustrous, insensitive, anterior chamber shallow, iris narrow, uniformly grey like blotting-paper, ectropion of

the uveal pigment, pupil dilated, immobile, often oval or eccentric, pupillary reflex dirty grey green, or a bluish white, swollen, silky cataract (Cataracta glaucomatosa); total cupping of the disc, halo glaucomatosus, tension much increased.

3. *Glaucoma simplex.* The most difficult form to diagnose; runs its course without pain, inflammatory symptoms, corneal haze, or dilatation of the pupil. Tension normal or only increased at times. In general the glaucomatous symptoms become more distinct during the course of the day, after prolonged use of the eyes. Excavation of the disc is more or less distinct, the visual acuity becomes gradually worse and the field of vision contracted, commencing on the nasal side and remaining more marked there. Ophthalmoscopic examination and functional testing are therefore indispensable for the diagnosis.

The history is usually characteristic in 1 and 2—misty vision, rainbows round lights and painful inflammatory attacks, whereas in 3 it is usually negative, or on stringent questioning one elicits an account of frequent headaches, temporal or occipital neuralgia, migraine, transitory slight obscurations or sensations of colours, which have been considered of no importance. If the patient is by chance seen in one of these attacks a slight dulness of the cornea and dilatation of the pupil are usually observed.

It should, therefore, be a rule in old people who complain of frequent headaches and neuralgia in the face, forehead, temple, or occiput, especially when combined with loss of appetite and sleeplessness, to think of the possibility of a *Gl. simplex*, and to examine minutely for its symptoms—tension testing, ophthalmoscopic examination. So also every patient of advanced age should be thoroughly examined with the ophthalmoscope, even if his complaint is only of presbyopia. If possible atropin should be avoided in old people, since it may bring on an attack of glaucoma when there is predisposition to it—shallow anterior chamber, somewhat dilated and sluggish pupil, full, even if not pathological tension, usually hypermetropia with diminution of the range of accommodation. There are also certain general predisposing causes, *e.g.*, hypermetropia,

arteriosclerosis, chronic constipation; the Jewish race is also predisposed, and heredity plays a part. If a strong mydriatic is absolutely essential, the tension must be kept under careful observation.

Differential Diagnosis. Apart from overlooking or failing to recognise the disease, especially in *Gl. simplex*, mistakes are very liable to occur in the inflammatory forms, particularly the acute, and these may lead to most disastrous results, owing to the diametrically opposite treatment (atropin) required.

(*a*) *Iritis.* The dilatation of the pupil in glaucoma, as well as the diffuse corneal haze, and increase of tension should eliminate this error.

(*b*) *Acute Ophthalmia.* Here there are increased discharge from the conjunctiva, with matted lashes and mucus or pus at the inner canthus, much photophobia, pain localised in the eye itself, little or no constitutional disturbance, cornea smooth and lustrous, iris not discoloured, pupil normal.

(*c*) *Amblyopia ex atrophia nervi optici.* Ophthalmoscopic examination decides. The field for colours disappears in optic atrophy before that for white. On the other hand nasal contraction of the field, misty vision and coloured haloes, and increase of tension are pathognomonic of glaucoma.

N.B.—Transitory coloured haloes may be caused by particles of mucus upon the cornea; these are seen especially in the morning after waking, and disappear on rubbing the eyes or douching them. In the same manner delicate corneal opacities may produce coloured haloes; they may be detected by oblique illumination.

Treatment of Glaucoma. The sovereign remedies are iridectomy and anterior sclerotomy, which must be performed as soon as possible. If the practitioner is not in a position to carry this out at once he must immediately instil strong myotics and repeat them twice or thrice daily; eserin ½ to 2 per cent.*

* In order to delay the decomposition of the solution, which manifests itself by the development of a red colour, acid. salicyl. 1 to 3 in 1000 may be added, or sodium sulphite gtt. 3 in 20 cc. solution; it must also be kept in a dark bottle, and protected from light. Pale red solutions are still active. After the instillation of eserin a somewhat severe burning sensation usually occurs, but soon disappears.

is the best of these, while pilocarpin 1 to 2 per cent. is slower and not so strong. At the same time the operation must be performed as soon as arrangements can be made. Before the operation a myotic must be instilled into *both* eyes; when inflammatory symptoms are severe it is advisable in order to diminish the pain and so facilitate the operation to instil also adrenalin (as solutio adrenal. hydrochlor. 1 in 1000, Parke, Davis & Co., Detroit, Michigan), or atrabilin (1 in 1000; a non-irritating, sterile, and permanent solution of the latter, with the addition of 5 per cent. chloretone, has been introduced by the same firm). In cases associated with severe pain 0·01 grm. (=gr. $\frac{1}{6}$) morphia may be injected $\frac{1}{4}$ to $\frac{1}{2}$ hour before the operation. In glaucoma with hæmorrhage into the anterior chamber, iris, vitreous, or retina (*Gl. hæmorrhagicum*) large doses of sodium bromide (1 to 3 grm.=gr. 15 to 45) should be given in order to reduce the blood pressure.

As regards choice of operation, it may simply be mentioned here that opinions are divided, but so much is certain, that in *glaucoma hæmorrhagicum* sclerotomy is almost always to be preferred, and that in cases in which a second operation is required on account of the continuance of the symptoms sclerotomy is also usually to be selected.

Treatment by drugs alone is suitable only as an adjuvant, in cases of chronic glaucoma without pronounced symptoms, and in *glaucoma simplex* with shallow cupping; yet in these cases operative treatment often also fails to produce a good result. If one eye has been lost from *glaucoma hæmorrhagicum*, or expulsive hæmorrhage after operation, and the other is also affected, the prolonged use of myotics is admissible as long as there is no rapid failure of vision.

It is an important rule that, after every glaucoma operation, the patient must frequently present himself for observation, and especially in chronic inflammatory glaucoma and *glaucoma simplex*, in which myotics must often be employed for years.

Sympathectomy, recently recommended, is a last resource, after repeated useless iridectomies or sclerotomies. It is only to be undertaken without previous iridectomy or sclerotomy, if these operations have proved harmful to the other eye; also

in *Gl. hæmorrhagicum* and *Gl. simplex* with much loss of vision (Axenfeld).

In *Gl. absolutum* no operation can restore the vision, and enucleation or neurotomy alone remain if there is much pain.

Glaucoma in Children (Infantile Glaucoma, Hydrophthalmos, Buphthalmos). In contradistinction to glaucoma in adults the chief symptoms here are enlargement of the eye, at first of the cornea, later of the whole globe, and a diffuse or cloudy striped opacity of the corneal stroma, over which the surface is dull. This opacity is distinguished from that left behind by interstitial keratitis by its uniformity (*i.e.*, it cannot be resolved into fine points or lines), the absence of precipitates ("k.p.") and of participation of the uveal tract, the dilated pupil, and, most of all, by the tension of the eye which is always raised in infantile glaucoma. Exact determination of the tension, if necessary during sleep or under an anæsthetic, is therefore indispensable.

Treatment consists in iridectomy or, better, sclerotomy, since repetition will probably be necessary. Myotics are always, and operation unfortunately often, useless.

Glaucoma secundarium. Causes: (1) Ectasiæ of the cornea, especially with incarceration of the iris and anterior synechiæ (staphylomata), corneal fistula, ectasiæ of the sclera; (2) Iridocyclitis, seclusio pupillæ; (3) Dislocation of the lens; (4) Swelling of the lens after wounds or operations; (5) Intraocular tumours; (6) Retinal hæmorrhages (*Gl. hæmorrhagicum*); (7) Choroiditis, myopia excessiva (rare).

Treatment is guided by the ætiology (cf. the individual headings). ad (1, 2) iridectomy; ad (4) paracentesis and evacuation of the lens matter; ad (5) enucleatio bulbi, exenteratio orbitæ; ad (7) repeated paracentesis, iridectomy.

In addition to increase of intraocular tension, its diminution or **hypotony** may here be mentioned. It is a symptom which indicates lessening of the contents of the eye, and is found after perforating wounds and ulcers, operations, open corneal fistulæ, after prolonged use of a pressure bandage, shrinking of the vitreous in commencing atrophia bulbi from iridocyclitis, detachment of the retina. Slight degrees are often present in

corneal inflammations and abrasions, contusions, paralysis of the sympathetic, and after cocainisation.

Treatment is indicated by the causes.

A peculiar rare form is **ophthalmomalacia,** or essential phthisis—*i.e.*, a spontaneous lowering of intraocular pressure, with diminution in the size of the globe, sometimes associated with photophobia, injection, and neuralgic pain. After existing for some hours or days it disappears spontaneously without sequelæ.

Treatment is directed only against the neuralgia—antipyrin, pyramidon, aspirin, constant current (1–2·5 milliampères for 3 to 6 minutes), morphia.

℞ Ergotæ . . . . . 1·0 grs. 15
Quin. hydrochlor. . . . . 2·0 grs. 30
Ferri sulph. . . . . 5·0 grs. 75
Ext. gentian. q.s. ut ft. pil. . . . 100
S. Two pills three times a day.

The action of these pills is slow.

THE SCLEROTIC

Ectasiæ of the Sclerotic. I. *Partial.* Circumscribed, dark slate-grey to bluish-black prominences of the sclera, the result of diminished resistance—cicatrices after inflammation and wounds, or increase of the intraocular tension—glaucoma, secondary glaucoma.

Staphyloma ciliare in the region of the ciliary body, behind the entrance of the anterior ciliary vessels.

St. intercalare in the most anterior part of the sclera, close to the limbus, in front of the entrance of the anterior ciliary vessels. These two are often combined as a diffuse ectasia of the anterior zone of the sclerotic.

St. equatoriale at the point of exit of a vortex vein.

St. posticum in axial myopia, only visible with the ophthalmoscope.

Posterior Scleral Protrusion of Ammon. A congenital incomplete closure of the fœtal cleft, associated with coloboma of the choroid and iris.

Sequelæ of anterior and equatorial ectasiæ: increase of tension, amaurosis, buphthalmos with its consequences—ectropion, catarrh, lagophthalmos, ulcus corneæ, panophthalmitis.

Treatment. At the commencement: pressure bandage, reinforced if necessary by paracentesis; iridectomy and sclerotomy to reduce the tension. Excision of the ectatic portion or enucleation for pain and the deformity or injurious consequences of enlargement of the globe. *St. posticum* and the scleral protrusion of Ammon are not amenable to treatment.

II. *Total.* Uniform bulging of the whole sclerotic from increase of tension; usually associated with staphyloma of the cornea. It can only occur in young patients with

yielding sclera. Enucleation on account of the danger of bursting, and to avoid the injurious sequelæ—ectropion, lagophthalmos.

Episcleritis. Patchy inflammation of the superficial layers of the sclerotic in the form of flat, bluish-red, painful and very tender nodules, over which the conjunctiva is movable but injected. The course is chronic, without the formation of ulcers, and it disappears either without leaving any trace or only a slight slate-grey, somewhat depressed cicatrix. It tends to recur.

Ætiology. Rheumatism, gout, influenza; often not ascertainable.

Treatment. General, for the primary disease: salicin, aspirin, general regimen. Local: dionin 5 to 10 per cent. ointment or solution, potassium iodide internally, or locally as an ointment, massage of the nodules. In the rare cases with much hyperæmia of the iris and pain: atropin, leeches, scarification of the nodules.

Good results have been recorded by von Reuss from the use of the electric current:

1. Constant current—at most 2·5 milliampères for 3 to 6 minutes; it may be applied in the form of the hydro-electric eye bath, which is filled with water, 1 to 2 per cent. lithium salicylate, or salt solution. One of the poles is contained in the wall, either the anode or kathode being used; the first has rather a soothing, the latter a stimulating action. The eye is dipped as deeply as possible in the warm fluid, through which the current is passed. It is said to be particularly soothing, and to diminish the tendency to recurrence. An electrode may also be placed directly upon the nodule after cocainisation: a current of 1 to 1·5 milliampères is employed for 1 to 1½ minutes, and repeated every second day.

2. Faradic current—conveniently applied in the form of the electric eye bandage, *i.e.*, a shell-shaped metal electrode, secured to the eye over a moist wad of cotton wool with a rubber bandage, the other pole being held in the patient's hand. Or the patient may hold one, the surgeon the other pole; the latter then closes the circuit by laying his other hand, which

is moistened, on the diseased eye. He can thus exactly gauge the strength of the current.

Episcleritis periodica fugax (Fuchs), Subconjunctivitis (v. Graefe).

Inflammation of the vascular episcleral tissue, lasting a few days, but recurring frequently. Great redness and œdema of the conjunctiva, often partial and varying in position, usually associated with rheumatism, arthritis, or influenza.

Treatment. Quinine, sodium salicylate, aspirin, massage of the affected spot, and general treatment of the rheumatism or uric acid diathesis.

Injuries of the Sclerotic. 1. *Superficial*—heal without trouble when not infected. Infection is shown by dirty deposits on the edges of the wound, and œdema and infiltration around; antiseptic ointments, cauterisation of the edges, and subconjunctival injections of sublimate are then employed. 2. *Perforating.* Symptoms of perforation: diminution of intraocular tension, absence of anterior chamber if this is involved, prolapse of parts lying under the wound—uvea, lens vitreous.

Associated phenomena: subconjunctival ecchymosis, hyphæma, hæmophthalmos (also in non-perforating injuries), iridodialysis, subluxation or luxation of the lens, detachment of the retina.

Perforating wounds may be incised or lacerated—ruptura scleræ, the latter may be caused by contusions with blunt bodies, often cow's horns. The tear may be subconjunctival or the conjunctiva may also be torn; they are most frequent up and in, close to the periphery of the cornea and concentric with it. The course varies according to whether a foreign body is in the eye or not.

(*a*) *No foreign bodies in the eye.* 1. Healing without inflammation: most rapidly in clean cut incised or punctured wounds. In wounds in the neighbourhood of the corneal periphery, including the wounds made in the extraction of cataract, iridectomy, and sclerotomy, firm healing may be hindered by incarceration of the iris or lens capsule—*cystoid cicatrix*, œdematous scar or cyst; this is dangerous on account

of the possibility of bursting and infection, often long after the injury (late infection), or of increase of tension. 2. Course with inflammation : infection occurs either from the injuring body itself or subsequently. It results in panophthalmitis with phthisis bulbi, or in iridocyclitis plastica with atrophia bulbi ; in the latter case there is danger of sympathetic ophthalmia.

(*b*) *Presence of a foreign body in the eye* makes any wound dangerous. First, from the fear of infection from the foreign body itself ; this is naturally least when the foreign body has been heated before entering, as in chips from hammers and explosions. Second, from the chemical irritation set up in the tissues ; in this respect iron and copper are the most dangerous, lead, gold, silver, and glass less so. Third, the danger varies according to the situation of the foreign body. The uveal tract, especially the ciliary body and iris, react most, the lens least. Lastly, the size of the foreign body is of importance.

Treatment. 1. Recent wounds.

The first point to be considered after cleansing the wound and conjunctival sac is whether a foreign body is present in the eye or not. Information is given by the nature of the injury and of the injuring body, *e.g.*, the presence of a foreign body is more improbable in a punctured or incised wound caused by a knife than in an incised or lacerated wound caused by flying splinters of stone, iron, or percussion caps. Weighty evidence is also given by ophthalmoscopic examination, if it is not made difficult or impossible by blood or opacities of the lens or vitreous. Investigation with the Röntgen rays is, however, invaluable. It permits not only of the foreign body being seen on the screen or photographic plate, but also of its being localised. The photographic plate is more sensitive than the human retina, and brings out plainly small bodies not visible on the screen. For localisation exact observations of the globe in different positions, taken in series, is necessary ; or the changes in position of the foreign body during movements of the eye as referred to pieces of lead fixed at the orbital margins permit its situation to be deduced. For example, if

the foreign body moves in the same direction as the globe it must be in front of the centre of rotation, and vice versa.* Conclusions may also be drawn as to the situation of the foreign body from the position of the perforation, and from the presence of a spot tender to pressure.

If the penetrating body is a splinter of iron it may be demonstrated by the sideroscope or electromagnet. The former is in principle a very sensitive, suspended magnetic needle, which is attracted by the foreign body when the eye containing it is brought near. With the electromagnet tearing or stabbing pain is experienced, or a localised protrusion of the sclera or iris becomes visible, or the foreign body itself suddenly appears in the wound or anterior chamber, when the eye is carefully and gradually approached to the pole.

If it has been definitely proved that a foreign body is present in the eye its immediate removal is imperatively indicated. If, however, there is extensive laceration of the globe with prolapse of vitreous, choroid, or iris, there is no hope of preserving the eye, and immediate enucleation is indicated in order to shorten the sufferings of the patient ; all the more so because at the same time this eliminates the danger of sympathetic ophthalmia.

There is little prospect of success in removing the foreign body except in the case of splinters of iron, when a strong electromagnet may be used. After carefully douching out the conjunctiva the eye is cautiously brought near the apparatus, the wound being directed towards the point of the magnet. The foreign body may slip through the wound either immediately or after repeated attempts, or it is distinctly seen to come against the sclera and bulge it forwards, in which case an attempt is made to bring it into the wound by turning the eye or head ; the wound must be enlarged if the splinter lies at right angles to it.

* Various methods have been devised for localisation, in which the eye is kept stationary, while two photographs are taken with the Crookes's tube at two points a known distance apart ; the distance from the pole to the plate being also known, the position of the foreign body is easily calculated. A convenient form of apparatus is that of Mackenzie Davidson.—Trs.

In the case of other kinds of foreign bodies, a fine pair of forceps is inserted through the wound towards its probable situation, and an attempt is made to extract it. This proceeding may be much facilitated if the globe is transilluminated. For this purpose a small electric light, mounted in an opaque sheath, with a conically ground piece of glass let in to concentrate the light, is used. This is placed upon the sclerotic, and illuminates the interior of the eye. If now one looks through the wound, held open, the foreign body is sometimes seen as a black object, and may be directly grasped.

After extraction of the foreign body prolapsed tissues are to be abscised, the conjunctiva carefully sutured over the wound, the eye douched antiseptically, and a bandage applied. Further treatment is guided by circumstances. If there is no inflammation or fever, nothing is necessary but the bandage and rest in bed. If there is some irritation of the iris atropin is instilled. If, however, iridocyclitis sets in, whether traumatic or from pyogenic infection, enucleation is indicated when the irritation continues to increase and is not brought to a standstill by antiphlogistic treatment—antropin, hot fomentations, dionin, leeches, subconjunctival injections of sublimate.

Frequently long after the foreign body has been successfully extracted, the wound having completely healed, an insidious iridocyclitis sets in with atrophia bulbi; this also demands enucleation. So, too, when the cicatrix becomes later much retracted, while the globe remains painful and subject to apparently causeless ciliary injection with photophobia, the eye must be removed.

If there is no foreign body, treatment depends upon the extent of the wound, the presence of prolapses of internal structures, and the amount of irritation of the wound and eye (infection).

Extensive damage of the globe, as already mentioned, requires enucleation unconditionally. Infection of the wound or interior of the eye, as shown by chemosis, discoloration of the iris, soiled prolapses, makes the prognosis with regard to preservation of the eye unfavourable in spite of antiseptic measures—cauterisation, injections of sublimate, introduction

of iodoform into the anterior chamber or vitreous; here also enucleation is required. If inflammatory symptoms are moderate expectant treatment may be adopted for a time, while using the measures mentioned above; if, however, the condition progresses the eye must soon be excised.

If the wound is small, clean cut, and with no prolapse or only a slight one, while the globe is free from irritation, the conjunctiva should be sewn over the wound after antiseptic irrigation and the excision of prolapsed structures. A bandage is then applied, the patient is kept in bed, the bowels are kept loose, and diaphoresis is employed in order to promote absorption of the blood. If, however, during healing pain, retraction of the cicatrix, and commencing shrinking of the globe occur, enucleation must be performed.

In any case the patient is not allowed to pass from observation without being earnestly warned of the possible dangers and the prodromata of sympathetic ophthalmia, and of the necessity for immediately presenting himself for examination should these occur.

II. *Old cicatrised injuries, cystoid cicatrisation.*

Here again an intraocular foreign body must be sought for, and if found localised and, when possible, removed.

Splinters of iron are carefully drawn into the anterior chamber, if this is feasible, and removed by a corneal incision, with iridectomy if they bulge forward the iris, but cannot be brought round the pupillary border. If they can be demonstrated lying in an easily reached position in the anterior portion of the globe they may be removed by a suitably placed incision; the conjunctiva is then sewn over the wound, a bandage applied, and further treatment regulated by the course of healing (*vide supra*).

Cystoid cicatrisation. Excision of the cyst and of the iris incarcerated in its floor, refreshing of the edges of the fistula, and covering with conjunctiva.

If an eye with an old cicatrised scleral wound is subject to frequent attacks of irritation and inflammation, the cicatrix painful and retracted, the eye amaurotic and already beginning to shrink, or the projection and perception of light poor,

enucleation is imperative on account of the danger of sympathetic iridocyclitis.

Rupture of the Sclerotic. (Cf. Injuries of the Sclerotic.)

Scleritis.

Ætiology. Chiefly in young people, but not infants; scrofula, tubercle, syphilis, anomalies of menstruation, gout, influenza; idiopathic.

Differential diagnosis from phlyctenular efflorescences: deeper situation, immobility when the conjunctiva is pushed aside, absence from the limbus, course slower and without ulceration.

Treatment. General treatment of the causal complaint, as well as diaphoresis. Local: dionin, especially if there is much pain, hot fomentations; if the nodules are not too painful, or the condition is improving, massage with boracic acid or yellow precipitate ointment, scarification. Electrotherapy (cf. Episcleritis) is soothing and aids absorption. For the treatment of complications, see the individual headings.

Staphyloma scleræ. (Cf. Ectasiæ of the Sclerotic.)

Tumours of the Sclerotic. 1. Primary: fibroma, osteoma, sarcoma; very rare. *Treatment.* Enucleation.

2. Secondary: originating in the conjunctiva, cornea, or choroid. *Treatment.* Enucleation or exenteration of the orbit.

Ulcers of the Sclerotic. Only secondary; (1) from breaking down of new formations—gummata, tubercle and leprosy nodules, malignant growths, or (2) from injury with infection.

Treatment. In gummata, energetic antisyphilitic treatment is adopted with a view to obtaining resolution; but in most of the cases under (1) enucleation becomes necessary. In (2) antiseptic douching and iodoform, sublimate or boracic acid ointment.

THE LENS

Aphakia. Absence of the lens, the result of operation—for cataract or myopia—or perforating injury. The eye is strongly hypermetropic as compared with its previous refraction, and has lost its power of accommodation.

Diagnosis. Scar in the corneal margin or anterior part of the sclerotic, abnormally deep anterior chamber, iris tremulous on moving the globe to and fro. In the pupil, which may show a post-operative coloboma, there is often a fine membranous after-cataract, which may have holes in it; or if this is absent the pupil appears pure black on concentrating light upon it with a convex lens; on the other hand, even a completely transparent lens under these circumstances appears light grey in consequence of unequal reflection due to differences of refrangibility of the layers. The most certain sign of aphakia is the absence of the Purkinje image from the posterior lens surface; this is a bright, but very small inverted image, moving in the opposite direction to the source of light.

Aphakia requires correction with glasses according to the state of the refraction, and since accommodation is lost, these must be different for distant and near vision.

Cataract is a general term including all opacities of the lens. These may lie in the capsule or in the lens substance itself, and are accordingly divided into:

Capsular Cataract	*Anterior* (or *anterior polar*).	A white sharply circumscribed opacity in the plane of the pupil.	*Congenital* usually bilateral. *Acquired* after penetrating ulcers of the cornea especially from blennorrhœa neonatorum. In the course of years the corneal cicatrix may clear up and entirely disappear.

- *Capsular Cataract* (contd.)
  - *Posterior* (or *posterior polar*)
    - *Congenital*: remains of the hyaloid artery. Usually only visible with the ophthalmoscope.
    - *Acquired* in retinitis pigmentosa and choroiditis.
- *Lenticular Cataract*
  - *Partial*
    - *Congenital*
      - Perinuclear cataract.
      - Fusiform ,,
      - Central ,,
      - Punctate ,,
    - *Senile.*
    - *Traumatic* with or without a wound of the globe.
    - *Complicated* caused by general metabolic diseases (nephritis, diabetes) or by diseases of the uvea or retina (iritis, iridocyclitis, choroiditis, myopia, detachment of the retina), or by glaucoma (cataracta glaucomatosa); more rarely by tetany, chronic napthalin poisoning, lightning stroke; lastly in glass-blowers.
  - *Total*

Partial cataract may occur in the anterior or posterior cortex, in the nucleus, or around the nucleus—C. corticalis anterior, posterior, nuclearis, perinuclearis sive zonularis. It may also be progressive or stationary.

It would exceed the aim and limits of this book to describe minutely all the forms of cataract, or the technique and indications for the individual methods of extraction. These demand special training, especially from the operative point of view; moreover, the time for undertaking most of the operations is not strictly defined, but varies within wide limits, so that the help of the specialist is available even for the indigent. On the other hand, the answer to certain questions which are only indirectly connected with treatment is of interest and importance to the general practitioner.

1. *Differential diagnosis of opacities in the pupil, in so far as they are of therapeutic importance.*

2. *What are the subjective and objective symptoms of a senile cataract at its commencement?*

3. *When is a senile cataract ripe for operation?*

4. *Should a senile cataract be operated on while there is good vision in the other eye?*

ad 1. *Differential diagnosis of opacities in the pupil.*

In order to decide the diagnosis, the eye must be examined by focal illumination and with the ophthalmoscope. Focal or oblique illumination is best carried out by bringing a convex lens of 15 to 20 diopters gradually nearer to the eye until daylight or, better, an artificial light is focussed at the plane of the pupil. In this manner very fine opacities, not visible to the naked eye, can be demonstrated and their structure examined. The opacities may be situated either at the level of the pupil itself (*i.e.*, on the anterior capsule), or immediately behind it, in the anterior layers of the lens—membrana pupillaris persistens, occlusio pupillæ, C. polaris anterior, corticalis anterior; or they may be deeper—C. nuclearis, perinuclearis, punctata, polaris and corticalis posterior, tumor intraocularis, pseudoglioma, ablatio retinæ. The most important points in diagnosis are the form and structure of the opacity, and the presence of the shadow of the iris—*i e.*, a non-illuminated crescentic zone on the side from which the light falls; this is broader the farther the opacity lies behind the anterior capsule of the lens.

1. *Opacities in the plane of the pupil.* No shadow from the iris.

(*a*) A more or less dense, whitish-grey, sharply circumscribed spot, with dull, slightly prominent surface, sometimes thicker at the margin of the pupil: *exudate* (occlusio pupillæ). This is usually accompanied by posterior synechiæ, with which the opacity is connected; on instilling atropin the pupil dilates completely or partially, the exposed part appearing black.

(*b*) Brown or greyish-brown spots or threads: *remains of posterior synechiæ, pigmented remains of the pupillary membrane.*

(*c*) Red or reddish-brown flakes or points: *blood.*

(*d*) Rusty brown nodules arranged in a circle corresponding with the pupillary margin; the iris at the same time of a greenish

colour : *Siderosis bulbi, deposits of rust on the anterior capsule of the lens.*

(*e*) Opaque, homogeneous, sharply defined, pure white spots usually of small size, and with a lustrous surface ; some lie behind the iris and only become visible on dilating the pupil with atropin : *Anterior capsular cataract.*

(*f*) Spoke, sector, rosette or polygonal forms of opacity or more rarely punctate or diffuse varieties ; they tend markedly to take on a radial arrangement, and have a satin- or mother-of-pearl-like sheen : *Anterior cortical opacities.* A small shadow is thrown by the iris, if they are not quite in the superficial layers.

2. *Opacities behind the plane of the pupil.* Artificial dilatation of the pupil is essential to the exact determination of their position and extent.

(*a*) Sectors of diffuse cloudiness. If they lie quite in the periphery they sometimes take the form of an arc or ring composed of exceedingly fine dots or lines, only visible under a mydriatic and on looking in very obliquely (Arcus senilis s. gerontoxon lentis). The cataract has a silky lustre, and can usually be resolved into linear or finely granular details. If a distinct shadow is thrown by the iris it is an *Incipient cataract*, and according to the depth of the opacity in the lens—which can be estimated, with some attention and practice—it is named *Anterior or Posterior Cortical Cataract.* If such an opacity occupies the whole area of the pupil, even under atropin, the cataract is far advanced.

(*b*) A round, ball-like opacity behind the plane of the pupil, as shown by the casting of a shadow from the iris ; more dense in the middle, grey or yellow and homogeneous, or more rarely with a slight lustre on focal illumination : *Central or Nuclear Cataract.*

(*c*) A disc-like, sharply defined, grey opacity, more dense in the periphery ; linear, punctate, and hook-like opacities at its border ; lies more distinctly behind the plane of the pupil than the last : *Perinuclear or Zonular Cataract.*

The deep situation of the opacity in (*b*) and (*c*) may be proved by noticing that between the pupillary margin and the

opaque layers a black crescent is visible, which always lies on the side of the pupil opposite to the observer when he looks in obliquely. On opthalmoscopic examination this crescent, which is the transparent portion of the lens lying in front of the opacity, appears red, while the opacity itself appears black.

(*d*) A disc-like or polygonal, dense homogeneous opacity, central in position, and estimated to be very deep in the lens is a *Posterior Capsular Cataract.* It has a greyish-white or yellowish colour, but with the ophthalmoscope appears to be black, or, if very dense, grey or white, and does not move relatively to the corneal reflex on movements of the eye.

If such an opacity has a radiate star-like form, it is a *Posterior Cortical Cataract.*

It is hardly possible to fall into error with regard to opacities of the vitreous or opaque masses projecting into it (tumour, exudation, detachment of the retina). The former are almost always movable, and it is easy to see that the clear reflex originates in the depth of the eye. In addition ophthalmoscopic examination will settle the diagnosis.

ad 2. *Symptoms of incipient Cataract.* The *subjective* symptom which leads the patient to seek advice is *disturbance of vision* either in the form of a constant diffuse cloudiness or of flying specks (*Mouches volantes*, *fliegende Mücken*), which, however, only move with movements of the eye ; they are, that is to say, always observed in the same part of the field of vision —a point of distinction from the flying specks seen when freely floating vitreous opacites are present. Another symptom is *Monocular Polyopia*, or the seeing of more than one image of an object with the eye. When cataract commences centrally the loss of visual acuity is relatively greater in good illumination on account of the narrowing of the pupil, so that *day-blindness* is produced ; on the other hand, when it commences peripherally, vision is worse in poor illumination, because of the dilatation of the pupil—*night-blindness.* Vision is more extensively and sooner impaired when the opacity it situated in the posterior layers of the lens. Not infrequently also myopia develops, so that the patient is unable to see well at a

distance, but finds that he can lay aside the glasses which he formerly required for reading.

The *objective* signs are the opacities visible, as described above, on focal illumination or ophthalmoscopic examination. Dilatation of the pupil is necessary for the examination, but atropin is never to be used for this purpose ; mydriatics whose action is brief must always be preferred, such as cocain, enphthalmin, and homatropin. After the use of cocain the eyes should be kept shut for about half an hour to prevent injury to the cornea in its anæsthetic condition.

ad 3. *When is a Senile Cataract mature ?*

The course of senile cataract is divided into four stages.

1. *C. incipiens.* The anterior chamber is of normal depth. In the lens there are discrete opacities in the form of spokes or sectors of diffuse cloudiness in the periphery or centre—in the latter case disturbance of vision is early and considerable ; or they appear as irregular networks in the posterior cortical layers or as an arc or ring parallel to the equator (Arcus senilis lentis) ; a rarer form consists in scattered cloudy patches.

2. *C. intumescens.* Anterior chamber shallower. In the pupil a bluish-white opacity with a silky sheen and radial striæ. The iris throws a distinct shadow.

3. *C. matura.* Anterior chamber of normal depth. The opacity is dull grey, yellowish or brownish, and without any striate arrangement, or at most with an indication of the star figure. The iris throws no shadow.

4. *C. hypermatura.* Anterior chamber abnormally deep. White spots and lines are visible both in the capsule and in the lens substance itself. The iris is sometimes tremulous ; subluxation or luxation of the lens may occur.

In general, operation should be postponed until the third stage, when it is technically easier and the lens can be more completely extracted. It may, however, be performed during the stage of intumescence when both eyes are equally affected, and when vision has sunk to the counting of fingers close to the eye or to bare perception of light, so that the patient can no longer go about alone. *The reaction of the pupil, the perception of light, and the projection must always be carefully*

investigated before operating (cf. Introduction). *There must be no conjunctivitis and the lacrymal passages should be normal.*

In bilateral central cataract temporary improvement of vision may be obtained by an upward iridectomy, provided that the cataract is no larger than the pupil. If however it is larger, the lens should be extracted, since an upward iridectomy will be useless, while an optical coloboma downwards and inwards will impair the visual result after extraction by causing dazzling. In this case it should be kept in mind that a needling will probably be necessary subsequently.

ad 4. If one eye has still useful vision for distance and for coarse near work, while there is a mature cataract in the other, it is usually advisable to postpone operation until the better eye has no longer the requisite visual acuity. It is true that the field of vision is enlarged by operating and, as it were, a "reserve" eye is made ready against loss of vision in the other, but these advantages do not always counterbalance the disadvantages of the great inequality of refraction in the two eyes, an inequality which does not permit of binocular vision, and which therefore cannot be fully corrected by glasses.

SPECIAL TREATMENT OF THE MORE IMPORTANT FORMS OF CATARACT

A. Uncomplicated Lenticular Cataract.

(*a*) *Partial Lenticular Cataract.* This is often associated with anomalies and pathological changes in the retina and choroid, so that the impairment of vision does not depend on the lenticular opacity alone—anterior and posterior cortical cataract in myopia, choroiditis, retinitis pigmentosa, fluidity of the vitreous, etc. Zonular cataract is often combined with anomalies in the division of the central vessels, inferior crescent, astigmatism, etc.

Treatment is therefore only to be undertaken when the disturbance of vision can be referred chiefly or entirely to the cataract. Careful functional testing and examination

with the ophthalmoscope are required to determine this point. Small, sharply defined lenticular opacities—central, punctate, and fusiform cataracts—require no treatment, and the same is true of anterior and posterior cortical cataracts associated with changes in the fundus. The latter two forms must not be mistaken for the cortical opacities in commencing senile cataract.

On the other hand, operative treatment is requisite in zonular cataract when there is much impairment of vision. Before deciding what operation is to be chosen, the visual acuity should be taken with undilated pupil and under mydriasis. If, in the latter case, there is decided improvement, and if the cataract is not progressing as shown by the absence of prominences and spokes and of demonstrable progressive loss of visual acuity, then an optical iridectomy downwards and inwards should be performed ; otherwise the lens should be removed. In young people—up to 30 or 35 years—a discission will be performed and repeated if necessary, or combined with a curette evacuation if the lens swells much ; the pupil must be kept widely dilated with atropin during all these procedures until the lens has beeen entirely removed. In old people a flap extraction must be employed.

(*b*) *Total Lenticular Cataract.* Removal of the lens, if soft, by discission with or without curette evacuation. In senile cataract, flap extraction.

B. Capsular Cataract.

Small central capsular cataracts do not impair vision to any great degree, and require, therefore, no interference. Posterior capsular cataracts are usually complicated with choroiditis, retinitis pigmentosa, etc., so that operation gives no prospect of success.

Large capsular cataracts taking up the whole area of the pupil demand an optical iridectomy.

Traumatic Cataract.

This results from injuries to the globe with or without laceration of its coat. Cataract without laceration occurs,

for instance, after contusions and lightning-strokes. The opacity may be partial or total, and in the former case may be progressive or stationary, and may be situated in the anterior or posterior cortex (anterior and posterior cortical cataract); or again, it may take the form of an opaque line through the whole thickness of the lens, corresponding to the direction of the wounding body.

The *treatment* depends chiefly on whether or not complications are present in the coats of the eye, and must be guided accordingly. (Cf. Injuries of the Sclera.)

For the cataract itself no treatment is required if the wound in the capsule is small or is covered with iris, so that it rapidly closes and no extensive opacity or swelling of the lens takes place. If, however, the partial cataract becomes total, it must be removed by discission with or without curette evacuation in young patients, or by a flap extraction in patients over thirty-five.

When the tear in the capsule is extensive, so that swollen lens masses escape, the mechanical irritation of the iris which they cause is to be combated by atropin. At the same time a close watch must be kept on the tension, and should it become raised the lens must be evacuated through a keratome incision. It is unnecessary to force the whole of the lens out, for any rough handling will cause iris irritation, or increase it if present. The remains may be left to absorb or to become enclosed again in the collapsed capsule; if necessary, the secondary cataract so formed may be needled or extracted, but only after the eye has been free from irritation for a considerable time.

Similarly, a traumatic cataract complicated with iridocyclitis is only to be extracted after a long interval, during which the eye has been completely free from inflammation; if there are numerous posterior synechiæ an iridectomy may be performed as a precautionary measure.

A traumatic cataract becomes shrunken after a while, and may then be removed by a linear extraction; if merely a thin membrane is present, a free pupil is procured by a discission, or an iridectomy. The latter operation is suitable where the

pupillary margin has become adherent to the shrunken capsule by a mass of exudation.

If at the time of the injury, or later, a suppurative infection has occurred, an attempt may be made to save the eye by the use of atropin, dressings soaked in sublimate solution, subconjunctival injections of salt solution, and the introduction of rods of iodoform into the anterior chamber. If these measures fail, the eye should be enucleated at once. Excision will also be necessary if a plastic iridocyclitis sets in, with shrinking of the globe.

Prolapsed iris, choroid, or vitreous, and large wounds of the cornea and sclera must be treated according to the rules given under the individual headings.

Complicated Cataract results from extensive corneal ulcers, iridocyclitis, choroiditis, chronic iridochoroiditis, high myopia, retinitis pigmentosa, detachment of the retina, and glaucoma absolutum. A distinction is drawn between *cataracta glaucomatosa* and *cataracta in oculo glaucomatoso*; in the former case the lens is much swollen and has a bluish white colour and a marked silky lustre, and is associated with a dilated, immobile pupil and amaurosis; in the latter case it has the appearance of an ordinary senile cataract.

It is important with regard to the treatment to be adopted to diagnose these complications. In the case of diseases of the anterior portion of the eye this is easily done by careful examination, which at once detects changes in the cornea and iris, synechiæ, exudate, etc. If, however, the disease is behind the opaque lens the diagnosis can only be made by testing the perception of light and the projection. The form and variety of the cataract itself often give a further indication of deep-seated mischief—anterior and posterior cortical cataract (in choroiditis, myopia and retinitis pigmentosa), fluidity of the lens substance, calcification, capsular thickenings, tremulous lens, etc.

When perception of light is poor or absent no operation should be performed, since it will be useless; otherwise it may be done when it is believed that an improvement in vision will be obtained, and in judging this we are guided by the

nature of the complication. The methods of operating are complex and vary somewhat in individual instances, so that these cases should be entrusted to experienced hands.

Ectopia lentis. A congenital malposition of the lens, usually upwards. It is commonly bilateral.

Symptoms. The anterior chamber is of unequal depth, being shallower on the side to which the lens is displaced. The iris may be tremulous on the opposite side. When the displacement is very pronounced the edge of the lens becomes visible in the pupil, especially when dilated, and monocular diplopia results.

The *treatment* consists in correction of the refraction with glasses. In marked ectopia it should be ascertained whether the vision after correction is better through the aphakic portion of the pupil (under atropin mydriasis) or through the portion containing the lens (without atropin). In the former case an iridectomy or an extraocular iridotomy (see p. 151) should be performed in the corresponding situation. No attempt should be made to remove the displaced lens, since it is technically very difficult and is liable to be followed by complications (iritis, etc.).

Precipitates on the lens. (Cf. "Precipitates," under Iris.)

Luxatio lentis. *Ætiology.* Trauma—usually associated with hæmophthalmos; fluidity of the vitreous with weakening of the zonule of Zinn (myopia, choroiditis, detachment of the retina); stretching of the zonule from general enlargement of the eye (buphthalmos), or from cataracta hypermatura, complicata or natans.

Forms:

1. Luxation into the anterior chamber.

2. Luxation into the vitreous. 1 and 2 may be followed by rise of tension.

3. Luxation under the conjunctiva in scleral ruptures.

4. Incarceration of the lens in the pupil.

Symptoms. Deep anterior chamber. Tremulousness of the iris in 2 and 3. In 2 the lens may be visible in the vitreous.

When the lens is dislocated into the anterior chamber it seems more convex than normal, and in certain positions of the light its edge appears as a bright gold yellow line; it looks

therefore like a drop of oil in the anterior chamber. The intraocular tension is usually raised, much ciliary injection is present and the eye is very painful.

In 3 the lens may be recognised under the conjunctiva by its form, but it is usually concealed at first by ecchymosis, and is therefore only visible as a localised prominence.

In 4 the margin of the lens (usually the lower) rests on the edge of the pupil so that the anterior chamber is of unequal depth in different parts, being deepest at the part in which the lens lies. In this position also the edge is visible on focal illumination as a glancing line. Symptoms of irritation are very pronounced.

Treatment. In all these forms diaphoresis and moist applications are employed if there has been an injury. When there is much irritation of the iris, but without heightened tension, atropin and hot fomentations. When there is rise of tension, myotics and operative measures (*vide infra*).

ad 1. Immediate removal of the lens, best by a downward flap incision. In order to prevent the lens from slipping back through the dilated pupil, the latter may be first contracted with a myotic.

ad 2. Extraction in this case is impossible. If the globe remains free from irritation, the refraction is corrected with glasses. If secondary glaucoma or iridocyclitis have set in, an attempt may be made to abate the pain, and combat the inflammation and rise of tension by an iridectomy. If this is without result, the eye should be excised, or an optico-ciliary neurotomy performed.

ad 3. The hæmophthalmos is treated by diaphoresis and later by potassium iodide and subconjunctival injections of salt solution. *After the scleral rupture has healed* the lens may be removed by incising the overlying conjunctiva.

ad 4. Extraction of the lens through an incision placed on the side where the chamber is not obliterated. By the use of myotics the lens can sometimes be brought entirely into the anterior chamber, when it is more easily extracted.

Subluxatio lentis. A subluxation usually becomes a luxation.

(*a*) Traumatic.

(*b*) Spontaneous (ætiology as in luxation of the lens.) Cataracta tremula.

(*c*) Congenital. (Cf. Ectopia lentis.)

Symptoms. (Cf. Ectopia lentis.)

Treatment. If the only symptom is impairment of vision the glass which corrects the refraction is prescribed. If iridocyclitis or secondary glaucoma has ensued they must be treated, or an attempt made to extract the lens. This is, however, extremely difficult, and is almost certain to be complicated with loss of vitreous. If the eye is already amaurotic it is best to enucleate.

Aniridia Irideremia. Absence of the iris.

(*a*) Congenital.

(*b*) Traumatic. (Cf. Injuries of the iris.)

Anisocoria. Inequality of the two pupils (see Iritis, glaucoma, motor anomalies of the iris).

According to some authors (Fuchs and others) it is always to be regarded as pathological, and due to a disturbance of the centrifugal nerve paths, either in the oculo-motor nucleus or in the nerve itself. Others, however (Schmidt-Rimpler, and others), recognise a congenital anisocoria associated with anisometropia or unilateral amblyopia. In addition, a temporary anisocoria may be produced atificially by the use of mydriatics or myotics.

Treatment can only be directed against the underlying nervous disease, of which the anisocoria is but a symptom. (Cf. Motor Anomalies of the iris.)

Anomalies of the Iris (*Congenital*).

1. *Aniridia.* Often combined with congenital corneal or lenticular opacities.

2. *Coloboma iridis.* Almost always directed downwards. It is distinguished from an artificial coloboma by having its limbs bordered by the sphincter pupillæ as far as the angle of the anterior chamber.

3. *Ectopia pupillæ* (Corectopia). Even in normal eyes the pupil is usually situated eccentrically—a little inwards and downwards. In the higher degrees of ectopia the displacement may take place in any direction, and is commonly combined with simultaneous ectopia lentis.

4. *Heterochromia iridis.* A difference in colour of the two otherwise normal irides. The eye which has the lighter-coloured iris often becomes affected with senile cataract earlier than the other.

5. *Membrana pupillaris perseverans.* A grey or brownish tissue, often in the form of exceedingly fine dots, lying on the lens capsule in the pupillary area. It also occurs in the form of grey or brown threads springing from the circulus anteriosus minor of the iris (this distinguishes it from stretched posterior synechiæ, which spring from the actual pupillary margin), and projecting into the region of the pupil. They do not prevent maximal dilatation of the pupil—also a point of difference from posterior synechiæ. Many such threads are often joined together to form arcades and interlacements, which represent the remains of the vessels of the fœtal pupillary membrane.

No *treatment* is required for these congenital conditions, but their recognition (especially 2 and 5) is of importance from the point of view of differential diagnosis.

Atrophy of the Iris is the result of long-continued iritis or glaucoma. It is characterised by loss of the pattern of the iris, so that in whole or part it assumes an even grey colour like blotting-paper. The whole stroma may even disappear, except a few fibres, only the pigmented layers remaining. The reaction of the pupil becomes more sluggish, and is sometimes lost; the pupil is dilated and in partial atrophy drawn out ovally towards the corresponding side. In advanced cases so little of the iris may be left that aniridia is simulated; ectropion of the uvea is usually present.

The *treatment* deals only with the causal disease (iritis, glaucoma).

Coloboma iridis. (*a*) Congenital; (*b*) Artificial. In a correctly formed coloboma the limbs—*i.e.*, the edges extending from the sphincter to the ciliary body—should be equally long. If the cut angle of the sphincter stands higher upon one side, entanglement of the iris in the wound, or its healing into the scar has occurred. An artificial coloboma is produced by the operation of iridectomy (optical, for glaucoma, etc.), or by

injury, the partial tearing away of the iris. (Cf. Injuries of the Iris.)

Cyclitis (Iritis serosa). Inflammation of the ciliary body alone, without involvement of the iris, is very rare.

Symptoms. Irritation slight or absent; iris normal; pupil usually somewhat dilated; precipitates ("k. p.") on the cornea, or hypopyon; vitreous opacities.

Treatment. (*Vide infra.*)

Cyclitis with Iritis; Iridocyclitis. The usual combination. Participation of the ciliary body in an iritis may be presumed:—when the inflammatory symptoms are severe—*e.g.*, when there is œdema of the lids; when the ciliary region is tender to pressure; when precipitates ("k. p.") are present, or the periphery of the iris is much retracted (total posterior synechiæ); when the disturbance of vision is greater than can be accounted for by the cloudiness of the aqueous; when the tension is abnormal (increased at an early stage, decreased later).

Treatment. In simple cyclitis: dark glasses; hot fomentations; atropin very cautiously, and when there are no symptoms of irritation not at all; resorbents—diaphoresis, iodides, sod. iodide. 3 to 10 grms.—dr. 1 to dr. 3—daily, subconjunctival injections of 10 per cent. iodipin (0·3 to 0·5 grm.—m.5 to m.8 two to three times a week), or

℞ Iod. pur. . . . . 0·01–0·02
Potass. iodid. . . . . 2·0
Aq. destill. . . . . 30·0
Sig. 1 cc.—m. 15 every 2 to 3 days;

or 5 to 10 per cent. salt solution (1cc.—m.15) every second day; general treatment according to the ætiology (anæmia, scrofula, syphilis, rheumatism). Cf. Iritis.

Cysts of the Iris. (Cf. Tumours of the Iris.)

Descemetitis (Aquacapsulitis, Hydromeningitis). The old term for precipitates or "Keratitis punctata."

Ectopia pupillæ. (Cf. Anomalies of the Iris.)

Ectropion of the Uvea is an accompaniment of advanced

atrophy of the iris after iridocyclitis or glaucoma. The pupil is bordered by a black rim of variable breadth; the iris itself is reduced to a thin strip.

No *treatment* is possible.

Hippus is rare, and consists in a clonic spasm of the sphincter with rapid variations between dilatation and constriction of the pupil. It occurs in commencing acute meningitis, general paralysis, epilepsy, disseminated sclerosis, neurasthenia, and hysteria.

It requires no special *treatment.*

Horner's Symptom Complex (Paralysis of the cervical sympathetic). Myosis (the dilatation of the pupil, much slighter than normal on shading the eye, is particularly striking); a moderate degree of ptosis (*Pt. sympathica*); sometimes enophthalmos; a difference in the dilatation of the vessels on the two sides of the face—in recent paralysis the paralysed side is warmer and redder, later this is reversed and it becomes paler, cooler, and sweats less.

Ætiology. Tumours in the neck; injuries—fracture of the clavicle, operations for the removal of tumours, etc. Central causes: diseases or injuries of the upper cervical spinal cord, tabes.

Treatment is usually ineffectual, but galvanisation of the cervical sympathetic may be tried. Tumours should be removed.

Hyperæmia of the Iris occurs primarily as the beginning of every iritis, and secondarily in acute conjunctivitis, especially gonorrhœal, — erosions of the cornea, keratitis, scleritis, choroiditis, and injuries of the globe.

Symptoms. Greenish discoloration of the iris (in brown irides the colour is rather reddish-brown or greenish-brown); slight constriction of the pupil and sluggish reaction; a little pericorneal (ciliary) congestion of the eyeball; photophobia; lacrymation.

Treatment is directed against the primary disease. Locally, in severe cases, mydriatics and dark glasses are employed; the eyes are protected from bright light, and are used as little as possible.

Incarceration of the Iris takes place into perforations of the cornea or anterior part of the sclera, the result of ulcers, wounds, or operations. When the incarceration is peripheral, especially after cataract extractions and iridectomies, firm healing of the wound is hindered, and a cystoid cicatrix may be formed. This appears as a vesicle-like prominence of the conjunctiva over the scar. [Cf. Prolapse of the Iris and Cystoid Cicatrix, under Sclera.]

Treatment is guided by the size and situation of the incarceration. When not too large it should be excised by trephining the cornea over it and freeing the iris all round, so that a regular coloboma results. The loss of substance may be covered with a conjunctival flap (see further under Prolapse of the Iris and Cystoid Cicatrix). As a prophylactic measure it is indispensable when performing an iridectomy to replace carefully the pillars of the coloboma.

Injuries of the Iris.

1. *Aniridia.* Complete abruption of the iris at the ciliary margin. The iris may remain rolled up into a ball in the anterior chamber, or be driven out through the wound.

Treatment. At first cold compresses. Enucleation of the globe will be required when the wound is large or infected, and when cyclitis and commencing phthisis bulbi have set in (on account of the danger of sympathetic ophthalmia).

2. *Coloboma traumaticum.* Partial tearing out of the iris.

Treatment. Atropin, cold compresses, bandaging, rest. When much inflammatory reaction sets in, the treatment is that of iritis ; otherwise, as in 1.

3. *Iridodialysis.* Partial traumatic separation of the iris from the ciliary body. The pupil is always flattened in the corresponding situation, its form being altered from the circular to the linear. A black segment becomes visible in the position of the dialysis, which may, however, at first be hidden by hæmorrhage.

Treatment. Atropin, antiphlogistic measures. When the globe is much disorganised it must be removed.

4. *Retroversion of the Iris* consists in the driving backwards

of the iris on to the ciliary body, so that a coloboma is simulated.

Treatment. Cold compresses for the hæmorrhage; bandaging; otherwise expectant, in the absence of other extensive injuries to the globe.

5. *Iritis traumatica.* Removal of foreign bodies and of crushed, incarcerated, or prolapsed portions of iris; drawing off of the lens when swollen or dislocated forwards; antiphlogistic treatment; atropin; iced compresses; bandaging; rest in bed.

6. *Radial ruptures of the pupillary margin* are recognised by the notched form of the pupil and the tears in the sphincter —only visible with the loupe when small. They are often the cause of traumatic mydriasis, a condition in which some degree usually remains permanently.

Treatment. Bandaging, rest, avoidance of mydriatics, so as not to enlarge the ruptures.

In all injuries of the iris which are associated with large wounds of the cornea or sclera, especially if these involve the region of the ciliary body, there is danger of secondary cyclitis and sympathetic ophthalmia. This occurs quite apart from suppurative infection. Enucleation (or exenteration) of the eyeball is the best preventive measure, and may be undertaken the more readily, since we can rarely hope to retain any vision in such cases.

Irideremia = Aniridia.

Iridodialysis. (*Vide* Injuries of the Iris.)

Iridodonesis. Tremulousness of the iris on movements of the eye; sometimes more pronounced at one part. It is a symptom of aphakia, luxation and subluxation of the lens, and fluidity of the vitreous in myopia.

Treatment. Nil.

Iritis, Iridocyclitis.

Objective Symptoms. Discoloration and swelling of the iris and dulling of its pattern. The aqueous is cloudy so that the pupil seems less black than normal, and in severe cases there is hypopyon, or fibrinous, gelatinous-looking exudation, which often resembles a dislocated lens in the anterior chamber, or

there may be a diffuse fibrinous deposit on the posterior surface of the cornea, and over the pupil (*occlusio pupillæ*). When there is much hyperæmia, hæmorrhage in the iris stroma, or hyphæma, may result. Adhesions between the iris and the lens capsule may occur at the pupillary margin (*posterior synechiæ*); these may be partial or affect the whole circumference (*seclusio pupillæ*), and in the latter case the iris becomes bulged forwards (*iris bombé*), and secondary glaucoma may ensue. When cyclitis is also present precipitates are found on the posterior surface of the cornea ("keratitis punctata"), and the angle of the anterior chamber becomes deepened in consequence of extensive, or even total, posterior synechiæ.

Subjective Symptoms. In acute cases photophobia, lacrymation, pain in and around the eye and disturbance of vision. In chronic cases only disturbance of vision, pain being absent or little marked. Between these two extremes all possible intermediate varieties are found.

Sequelæ. Atrophy of the iris; secondary glaucoma in consequence of seclusio pupillæ or cyclitis; atrophia bulbi after total posterior synechiæ; cataracta complicata, accreta, calcarea; deep corneal opacities.

Ætiology. Primary: syphilis (hereditary or acquired), scrofula, tuberculosis, rheumatism, gonorrhœa, acute infectious diseases, diabetes; traumatic, sympathetic, idiopathic.

Secondary: keratitis, scleritis, cyclitis, choroiditis, retinitis.

Iritis diabetica. Comparatively mild, but often with much exudation, hypopyon, dark-coloured precipitates.

Iritis gonorrhoica. Usually in the later stages after other affections have appeared, in consequence of general infection with the gonorrhœal virus; it occurs, however, without these. It is liable to exacerbations, with simultaneous recurrences of the urethritis and arthritis.

Iritis idiopathica. Acute or chronic. In the latter case it is usually associated with cyclitis and there are very numerous fine precipitates ("k.p."), vitreous opacities, often choroiditis, retinitis, optic neuritis, and cataract; the eyeball is pale and

painless, and it causes annoyance only by lowering the visual acuity.

Iritis rheumatica. Inflammatory symptoms marked; numerous, but fine posterior synechiæ; great tendency to recurrence.

Iritis scrofulosa. Characterised by large fatty-looking, or spongy, yellowish-grey precipitates ("mutton-fat k.p."); pain slight.

Iritis sympathica. I. Prodromal stage, or stage of sympathetic irritation. Photophobia; rapid exhaustion by near work, from weakness of the accommodation; rarely pain, which may be at a point corresponding to the situation of the injury in the other eye.

II. Fully developed iridocyclitis. Slighter form; iritis serosa—*i.e.*, a pure cyclitis. Severer form: iridocyclitis, usually of subacute type, commencing insidiously or suddenly, but never sooner than 4 to 8 weeks after the injury to the other eye. Almost always precipitates; rarely hypopyon; numerous fine vitreous opacities; slight swelling of the papilla.

Sympathetic iritis is not to be dreaded in phthisis corneæ, staphyloma corneæ, glaucoma absolutum, or phthisis bulbi; nor in atrophia bulbi, so long as the eye is free from irritation and not painful either spontaneously or to pressure. *Prophylaxis* is of the first importance. It is best to enucleate in the following cases: eyes with extensive wounds especially in the ciliary region; eyes containing foreign bodies which cannot be extracted; eyes with old wounds or iridocyclitis which frequently and spontaneously become inflamed and painful. If enucleation cannot be carried out, such eyes must at least be kept under observation, and the patient must be thoroughly impressed with the danger he runs. The prodromal symptoms should be described to him, so that he may seek medical advice in good time should they appear. Prophylactic enucleation is only contra-indicated if the eye has still useful vision, or if this may be obtained by operation (iridectomy, cataract extraction, etc.).

Treatment. (See later, p. 154.)

Iritis syphilitica. Tends to recur frequently, and to

be associated with disease of the posterior parts of the globe.

1. Usual picture of iritis: commonly in the secondary, rarely in the tertiary stage of syphilis.

2. *Iritis papulosa*, or "condyloma" of the iris: yellowish-red flat nodules in the swollen, greenish iris, either at the pupillary or ciliary border. They occur in the secondary stage of syphilis, and are absorbed under antisyphilitic treatment, leaving behind atrophic spots and broad posterior synechiæ.

3. Instead of these macroscopically visible circumscribed nodules, a diffuse infiltration of the pupillary or ciliary portion of the iris may develop. This appears clinically as a very considerable sausage-like swelling, and leaves behind exceedingly firm, broad posterior synechiæ. This form also occurs in the secondary stage.

4. *Iritis gummosa* is very rare and occurs in the tertiary stage. Yellowish spongy nodules are found, which may become very large. They finally degenerate or break through at the corneo-scleral margin, in which case atropia bulbi is usually the final result.

5. *Congenital syphilis.* The iritis is usually combined with keratitis interstitialis, but may also occur without this.

Iritis traumatica. Causes: Mechanical lesions, chemical irritations, infection. Perforating wounds, swollen particles of lens matter, subluxated or luxated lens, tumours or cysticercus intraocularis. (Cf. Injuries of the Iris.)

Iritis tuberculosa. 1. Disseminated or miliary. 2. Solitary tubercle. (Cf. Tumours of the Iris.)

Treatment of Iritis and Iridocyclitis.

1. Causal, directed against the primary disease. When this cannot be ascertained with certainty, diaphoresis and mercury should be employed in severe cases to hasten resorption, provided that these are not contra-indicated by anything in the general condition of the patient.

2. *Symptomatic.* Here mydriatics are of chief importance. They diminish the hyperæmia by lessening the size of the iris, free synechiæ by dilating the pupil, and give the iris

rest by paralysing the sphincter. The most useful of these is atropin, which, however, must be replaced by another mydriatic when symptoms of poisoning are produced—malaise, dryness of the throat—or when atropin conjunctivitis, or a recurrent scarlatinal or erysipelatous erythema occurs. As substitutes, scopolamin hydrobromate, duboisin sulphate, or homatropin hydrobromate may be employed. The latter of these, however, has a comparatively weak action, and is mostly used to demonstrate the presence of synechiæ and to facilitate ophthalmoscopic examination.

These mydriatics are employed in ½ to 1 per cent. solution, ½ per cent. ointment, or in the form of gelatine tabellæ. The amount should be regulated by the condition of the iris, and no more than is necessary should be employed. Too frequent instillation is useless, and may do much harm by causing irritation of the conjunctiva—atropin catarrh. When there is much hyperæmia of the iris, solid atropin may be employed with the precautions mentioned under keratitis, or the atropin may be combined with cocain. The most powerful action is obtained by instilling it before going to bed, on account of the cessation of the movements of the pupil during sleep.

When we have succeeded in dilating the pupil thoroughly, and, so far as possible, in rupturing or stretching the synechiæ, and when at the same time a diminution of the inflammation is noticeable, the atropin may be diminished, so as just to keep up the necessary mydriasis. In old people especially, the long-continued use of atropin is, whenever possible, to be avoided on account of the ease with which an attack of glaucoma may be induced. When there is increase of tension —in cyclitis or seclusio pupillæ—the use of atropin must at once be given up. The action of the atropin may be aided by the use of dionin (cf. Keratitis, ulcus corneæ) or adrenalin, which at the same time diminish the pain.

In addition to atropin, moist heat should be made use of, best in the form of compresses for 2 to 3 hours daily. Cold applications are only to be recommended in traumatic iritis. When there is much hyperæmia the application of 6 to 8 leeches or Heurteloup's artificial leech to the temple has a

good effect; or diaphoresis with a hot-air apparatus, or with salicin, aspirin, or pilocarpin. Diaphoresis may also be used to promote resorption, along with treatment by mercurials, or, when the more severe inflammatory symptoms have subsided, subconjunctival injections of salt solution (5 to 10 per cent., 0·5 to 1 cc.—m. 8 to m. 15, every second day), or hetol 1 per cent. Hetol is especially employed in tuberculous iritis. *Both* eyes should be protected from light by darkening the room or by dark glasses, and the eyes should be used as little as possible; the general regimen should be antiphlogistic, and the bowels must be kept open. For severe pain the best remedies are hot fomentations, leeches, dionin, ointments of belladonna to the forehead (*vide* Appendix), electricity (cf. Episcleritis). When all these means do not give satisfactory results, an attempt may be made to improve the metabolism of the iris by a paracentesis of the cornea, with cautious drawing off of the aqueous; the wound should be reopened daily. While inflammatory symptoms are still present, iridectomy should only be performed as a last resort, when it is urgently necessitated by increase of tension.

After the inflammation has run its course, various sequelæ have still to be combated.

1. *Vitreous opacities.* Subconjunctival injections of salt solution or iodipin, instillations of dionin, diaphoresis, potassium iodide internally.

2. *Posterior synechiæ.* Attempt to free them with atropin—solution, solid, or combined with cocain—or by the alternate use of mydriatics and myotics. When synechiæ are present in almost the whole circumference of the pupil an iridectomy should be performed—especially in chronic iritis—to prevent recurrences and seclusio pupillæ.

3. *Occlusio pupillæ.* When the membrane is thick and vision therefore much impaired, an optical iridectomy, downwards and inwards, should be undertaken, or an extraocular iridotomy.*

* Extraocular iridotomy is performed thus: an incision is made at the limbus with a keratome, and through this the iris is drawn out and a cut made in it in a radial direction from the pupil to the periphery, no part being, however, excised; it is then replaced. In this manner the danger of wounding the lens is avoided.—Trs.

4. *Seclusio pupillæ.* An iridectomy should be performed at once, or when this is technically impossible from the marked bulging forward of the iris, after having first transfixed the latter.

5. *Total posterior synechiæ.* On account of the cyclitic membranes, iridectomy alone is not practicable, but must be combined with simultaneous extraction of the lens by Wenzel's method.*

In 3, 4, or 5, if the lens is absent, iridotomy should be done in place of iridectomy.

"Keratitis Punctata." (*Vide* Precipitates.)

Lens-like (gelatinous) exudate in the anterior chamber. This is a fibrinous exudation, which is often bounded by a convex border, and so resembles a semi-transparent lens in the anterior chamber. It soon shrinks to a little flake and may quite disappear. (Cf. Iritis.)

Melanoma iridis. (Cf. Tumours of the Iris.)

Motor Anomalies of the Iris.

I. *Mydriasis.* Pathological dilatation of the pupil.

(*a*) Spastic : an accompaniment of states of cerebral irritation, in many forms of migraine, and in irritation of the sympathetic.

(*b*) Paralytic ; from paralysis of the branch of the oculomotor to the sphincter iridis, usually combined with paresis of the ciliary muscle (paralysis of accommodation)—ophthalmoplegia interna. It occurs either in conjunction with paralysis of other branches of the oculomotor, or as an isolated phenomenon —in tabes, general paralysis, syphilis ; poisoning, especially with the mydriatics or with ptomaines (meat, fish, fruit) ; after diphtheria, in which case, however, the paralysis is almost always of the ciliary muscle and not of the sphincter ; traumatic after contusion of the globe ; lastly, in glaucoma.

Treatment must be directed to the causal disease ; locally, myotics and electricity may be used. Post-diphtheritic paralysis of the accommodation disappears of itself, but its cure may be hastened by general tonic treatment.

* Wenzel's Method consists in an extraction with a flap section made downwards, in such a way that the knife is carried not only through the cornea, but also through the iris and anterior capsule of the lens.—Trs.

II. *Myosis*. A pathological constriction of the pupil.

(*a*) Spastic: commencing meningitis; the use of myotics, opium, chloral, nicotin, alcoholic poisoning; sometimes in hysteria.

(*b*) Paralytic (spinal myosis): paralysis of the cervical sympathetic (cf. Horner's symptom complex), tabes, general paralysis. In the latter two conditions the so-called Argyll-Robertson pupil is often found—reflex immobility of the pupil, *i.e.*, absence of the light reaction, with preservation of the reaction to accommodation and convergence.

Treatment. That of the primary disease.

Mydriasis. (Cf. Motor Anomalies of the Iris.)

Myosis. (Cf. Motor Anomalies of the Iris.)

Occlusio pupillæ. Closure of the pupil, which causes loss of visual acuity. (Cf. Iritis.)

Treatment, when vision is much impaired, iridectomy or extraocular iridotomy.

Precipitates ("*Keratitis Punctata*"). (Cf. Cyclitis.) Deposits on the posterior surface of the cornea, in the angle of the anterior chamber, on the iris, or on the anterior lens capsule in the pupillary area. They are diagnostic of an inflammation of the ciliary body—cyclitis, iridocyclitis, keratitis, especially interstitial. They appear as small (sometimes scarcely visible), round, brownish, or yellowish-grey points, chiefly in the lower half of the anterior portion of the eye. In syphilitic, scrofulous and tuberculous iridocyclitis, larger, spongy, greasy-looking, grey or yellowish deposits occur ("mutton fat k.p.").

Precipitates of lens matter are rare. The deposits are bluish-white, transparent, glassy, and irregular in form, and consist of swollen fragments of lens which have escaped from the capsule. They require no treatment *per se*.

The *treatment* combats the cyclitis, iridocyclitis, or keratitis, of which the precipitates are a symptom. Only when they are very abundant is an attempt to be made to remove them, at least partially, by evacuating the aqueous and so flooding them out. This treatment at the same time has a beneficial action on the primary disease.

Prolapse of the Iris is a consequence of perforations of the

cornea in the area of the iris, or of the most anterior part of the sclera, in consequence of wounds or perforating ulcers. It may be partial or total, and soon becomes covered with a deposit of fibrin, and adheres to the sides of the perforation. The resulting cicatrix may be flat or ectatic (Cicatr. corn. c. synech. ant., myocephalon, leucoma adhærens, staphyloma corneæ partiale s. totale, phthisis corneæ).

Treatment. Recent small prolapses must always be excised, after freeing the adhesions all round from the sides of the perforation. So much iris should be excised that a properly formed coloboma, with free pillars, results. In old prolapses, in order to avoid rise of tension, the cicatrix should be trephined when flat, and the iris then freed ; or an iridectomy may be performed. An attempt may be made in some cases, where the prolapse is not peripheral, to divide the adhesion with a Graefe's knife without trephining, but the results are inferior to those obtained by the other method. Large prolapses, when they threaten to become ectatic, should be punctured or partially excised. (Cf. Ectasia corneæ.)

Retroversion of the Iris. (Cf. Injuries of the Iris.)

Seclusio pupillæ, or shutting off of the pupil, is the consequence of ring synechia of the pupillary margin with the lens capsule or cornea (after central perforating ulcers).

It leads to a convex bulging forwards of the iris (iris bombé) and secondary glaucoma, and must be at once treated by operation. When the anterior chamber is very shallow the bulging iris should be transfixed with a Graefe's knife introduced at the limbus ; otherwise iridectomy should be undertaken. If the lens is absent, iridotomy may be performed by cutting through the iris and any membranes or remains of lens lying beneath it with a Graefe's knife ; the incision should lie perpendicularly to the direction of greatest tension in order to obtain the widest possible gaping of the wound. Afterwards atropin is instilled, and when necessary the iritis treated.

Sympathetic Iridocyclitis. This disease occupies a place apart, on account of its cause, and the very great frequency with which it leads to destruction of the affected eye. The prophylaxis has been referred to above. When sympathetic

iridocyclitis has already broken out, the enucleation of the exciting eye is demanded, provided that there is no useful vision in it, nor any hope of obtaining useful vision by operative interference. Yet even this measure is not always successful.

Where some vision remains in the exciting eye it should not be enucleated at once, but the sympathising eye should be treated according to the rules given above; protection of the eye from light—best with a bandage—is of much importance. Operative measures should, whenever possible, be postponed until the eye has been long free from irritation; even when the tension is raised myotics should be tried first. In addition, an energetic course of mercurial inunction should be commenced, and subconjunctival injections of salt solution or sublimate used.

Synechiæ, Anterior. (Cf. Incarceration, and Prolapse of the Iris.)

Synechiæ, Posterior. Adhesions between the iris and lens capsule, in consequence of inflammation. They affect either the pupillary margin alone, in part of its circumference or all round (posterior ring synechia or seclusio pupillæ), or the posterior surface of the iris partially or totally (total posterior synechia).

Treatment. An attempt is made to free the synechiæ by mydriatics, or by the alternate use of myotics and mydriatics (cf. Iridocyclitis): even if this is unsuccessful the adhesions may become stretched, when they appear as brown or grey stripes, projecting into the pupillary area from the free border of the iris. When the synechiæ are very numerous an iridectomy must be performed, in order to prevent the occurrence of seclusio pupillæ.

In total posterior synechia the anterior chamber may be normal, or, in consequence of the shrinking of cyclitic membranes, abnormally deep. In other cases, where there is much cicatricial shrinking of exudates behind the lens, the chamber may be shallower or absent altogether, but this occurs uniformly and not, as in seclusio pupillæ, with a deep portion in the centre corresponding to the pupil. Ordinary iridectomy

is impossible in total posterior synechia from the firmness of the adhesions; it may be carried out with simultaneous extraction of the lens by Wenzel's method (*vide* p. 152, footnote). In aphakic eyes iridotomy may be performed.

Tremulous Iris. (Cf. Iridodonesis.)

Tuberculosis iridis. (Cf. Iritis and Tumours of the Iris.)

Tumours of the Ciliary Body. Myoma, myosarcoma, and lepra nodules are rare forms; the following are commoner.

(*a*) *Sarcomata.* At first these are hidden by the iris; but later, by looking in obliquely and with a fully dilated pupil, they may be observed as greyish-brown prominences. In their further growth they usually penetrate the root of the iris, and appear in the anterior chamber.

Treatment. Excision of the eyeball as soon as the diagnosis has been made with certainty.

(*b*) *Gummata.* Yellow-grey, breaking down masses penetrating, like the last, into the anterior chamber, or more rarely, through the sclera along the anterior ciliary vessels.

Treatment energetically antisyphilitic. Locally: atropin, hot fomentations, dark glasses. When there is much iridocyclitis, and the sclera is extensively destroyed, excision of the globe. This should also be performed when, after healing or breaking through, a painful atrophic ball is left not free from inflammation.

Tumours of the Iris.

1. *Serous Cysts.* Usually after perforating wounds of the cornea. A grey transparent cyst arising in the iris stroma, and gradually growing towards the posterior surface of the cornea. Often results in secondary glaucoma and blindness.

Treatment. Operative; removal as completely as possible, through an incision in the periphery of the cornea.

2. *Tuberculosis.* (*a*) Disseminated, miliary tubercles. Inflammatory symptoms and pain usually slight; grey, fatty nodules in the iris stroma, which may be spontaneously absorbed; almost always combined with iridocyclitis.

(*b*) Solitary tubercle. Appears as a grey or yellowish-grey tumour, without marked inflammatory symptoms. It slowly perforates the globe at the periphery of the cornea, and in

contradistinction to sarcoma, breaks down and leaves an atrophic eyeball.

Treatment. General antituberculous treatment.* Locally: that of iritis. Spontaneous cure sometimes occurs. Enucleation should be performed when the disease is progressing, when the ball is becoming atrophic, as shown by lowered intraocular tension and poor projection, or when the eye is amaurotic.

3. *Pseudotuberculosis.* Tubercle-like nodules occur along with iritis in leukæmia and pseudoleukæmia (rarely); also from the entrance into the anterior chamber of the hairs of certain caterpillars—*ophthalmia nodosa.* Nodules may also occur simultaneously in the conjunctiva and cornea.†

Treatment is the same as that of iritis. Solitary nodules, if they do not respond to other means, may be excised along with the affected portion of the iris.

4. *Syphilitic tumours*—usually condylomata (papules). Brown-red or yellow-red flat tumours at the pupillary or ciliary margin of the iris, which become absorbed under antisyphilitic treatment. Gummata are rarer and appear as yellow, spongy nodules, which may grow to great size and even break through externally. If this happens enucleation will usually become necessary finally, in spite of energetic antisyphilitic treatment.

5. *Sarcomata.* Vascular, quickly growing, usually pigmented, often breaking through externally. They may arise from any part of the surface of the iris, a point of distinction from condylomata. Iritis only occurs somewhat late in its

* Recently very good results have been reported from the use of subcutaneous injections of tuberculin (tuberculin in water 9; glycerin 1) in increasing doses. At first about $\frac{1}{1000}$ milligram is used daily, the dose, regulated according to the reaction, rising rapidly later to 3 to 5 milligrams. The introduction of air into the anterior chamber, and subconjunctival injections of 1 per cent. hetol (1 cc.—m. 15 every second or third day) have also been practised.

† In order to make the differential diagnosis subcutaneous injections of tuberculin may be employed. 1 to 2 milligrams are injected to commence with, and if no rise of temperature occurs within three days, 3 milligrams more are used, or, after another two days, 5 milligrams. If even then no rise of temperature is observed, it is at least very unlikely that the nodules are tuberculous.

course. In doubtful cases mercurial treatment may be tried and will have no effect on a sarcoma.

Treatment. If very small, total removal by an extensive iridectomy is possible. Otherwise the globe should be excised, or if the tumour has already broken through externally the orbit exenterated.

6. *Melanoma.* An innocent, black tumour, situated either in the iris stroma or at the pupillary margin—the equivalent of the "grape clusters" of the horse. They may fall off and lie free in the anterior chamber, or float in the aqueous. They grow very slowly or not at all, but may, though rarely, give rise to sarcomata.

When rapidly increasing in size under observation they should be excised.

7. *Myomata, Leprosy nodules.* Very rare. Excision of the tumour, if necessary enucleation of the globe.

8. *Granuloma.*

(*a*) Old name for the solitary tubercle.

(*b*) Granulating prolapse of the iris.

THE VITREOUS BODY

Fluidity of the Vitreous. Occurs as a result of diseases of the choroid and retina, and also in ectatic eyes. It leads to lowering of the intraocular tension, separation of the retina, and tremulousness or luxation of the lens. Not infrequently there is a formation of cholesterin crystals, which float about in the vitreous in the form of glittering specks (*synchysis scintillans*). This occurs also without any of the above-mentioned diseases, in the otherwise normal eyes of old people.

Treatment is of no avail.

Foreign Bodies in the Vitreous.

1. Foreign bodies in the narrower sense, which have entered through a perforating wound.

These must be removed as soon as possible, on account of the iritis which may be set up, even after a considerable interval, and the danger of sympathetic inflammation in the other eye. Their extraction also becomes more difficult later, on account of the increasing opacity of the vitreous. The diagnosis is made with the ophthalmoscope, provided that the media are clear or not too opaque ; with the sideroscope and electromagnet in the case of splinters of iron ; and with the Röntgen rays. (Cf. Injuries of the Sclera.)

The best prospect of successful extraction is afforded by splinters of iron. It is performed through the recent wound, or in old cases through a meridional incision in the sclera (for details see Injuries of the Sclera). If their removal cannot be effected, further interference is only to be abstained from, if the eye remains quite free from irritation. Should, however, severe inflammation set in, or be already present, it is imperative to enucleate, on account of the danger of sympathetic ophthalmia.

2. Foreign bodies in the wider sense—*dislocated lens*,

cysticercus. The removal of the former without damage to the eye from loss of vitreous and separation of the retina is practically impossible. It should therefore be left alone. If iridocyclitis or secondary glaucoma ensue, an iridectomy may be performed to combat these complications, or if this is without effect, an optico-ciliary neurotomy or enucleation of the ball. On the other hand the removal of a cysticercus must be undertaken at the earliest possible moment; otherwise the eye will be lost from iridocyclitis. Unfortunately the results are by no means always good, but at least it should always be attempted.

Opacities of the Vitreous. In the form of freely movable dust, flakes, threads, meshworks, or membranes. The subjective complaint is of myodesopsia (*Mouches volantes, fliegende Mücken*) and of diminished visual acuity. The diagnosis can only be confirmed with the ophthalmoscope. Neurasthenics often complain of myodesopsia, although nothing can be found with the ophthalmoscope. It is possibly caused by physiological opacities in the vitreous, and is especially noticed on looking for a long time at a bright, uniformly lighted surface.

Causes. Inflammation of, and hæmorrhage (spontaneous or traumatic) from, the uvea and retina.

Treatment consists in the use of sorbifacients, but there is little prospect of success except in recent cases. Diaphoresis is especially indicated—*e.g.*, by aspirin (2 to 4 grms.—dr. ½ to dr. 1) or sod. salicylat. (2 to 6 grms.—dr. ½ to dr. 1½ before going bed). Russian and Turkish baths have a greater effect, and electric and light baths may also be used.

A further means of obtaining absorption is by subconjunctival injections of 5 to 10 per cent. salt solution or sodium iodide solution, or

℞ Iodi puri . . . . . 0·01–0·02
Potass. iodidi . . . . . 2·0
Aq. destill. . . . . 30·0
S. 0·5 to 1 cc.—m. 8 to m. 15, every second or third day,

or Iodipin 10 per cent. (Cf. Introduction.)

In syphilitic cases energetic mercurial treatment must be instituted, best by inunction of 3 to 4 grms. (dr. ½ to dr. 1) per day in adults, or of 0·3 to 1·5 grms. (gr. 5 to gr. 20) in children. Or pills may be used.

℞ Hydrarg. perchlor. . . . . 0·1 grm. (gr. 1½).
Kaolin q.s. ad pilul. . . . 100
S. Begin with three pills daily and increase the number by one per day until ten are being taken.

Or—

℞ Hydrarg. perchlor. . . . . 0·3 grm. (gr. 5).
Quinin. hydrochlor. . . . 0·6 „ (gr. 10).
Succ. liquir. . . . . 9·5 „ (dr. 2½).
Ft. pil. 60
S. One to two pills three times a day after food.

Or intramuscular injections (cf. Introduction) of 1 per cent. sublimate solution with 5 per cent. salt solution—25 to 30 injections in all; or

℞ Hydrarg. bicyanid. . . . . 0·1
Glycerin. . . . . 2·0
Aq. destill. . . . . 18·0
S. 1 cc.—m. 15—daily.

℞ Hydrarg. sozoiodol. . . . . 0·8
Potass. iodid. . . . . 1·6
Aq. destill. . . . . 10·0
S. 1 cc.—m. 15, daily.

℞ Hydrarg. salicyl. . . . . 1·0
sive Hydrarg. thymoli. . . . . 1·0
Paraffin liquid. . . . . 10·0
S. 1 cc.—m. 15 every 5 to 7 days (6 to 10 injections in all).

Finally, saline mineral waters are useful, Marienbad, Kreuzbrunnen, Franzensbad, Elster, Tarasp (Ursusbrunnen), etc.

Treatment must be continued for weeks or months, since

improvement is often only noticeable after a considerable time.

Prolapse of the Vitreous. After perforating wounds of the globe. If the prolapse is small it may be snipped off and the conjunctiva sutured over the wound; if large, it is always associated with severe complications, which make enucleation imperative.

THE CHOROID

FACILITY in the use of the ophthalmoscope is necessary in order to diagnose diseases of the choroid, and since a description of them which would be of any value, especially to beginners, cannot be given in a few words, readers must refer to the text books for fuller details.

Ablatio choroideæ (Detachment of the Choroid). Visible with the ophthalmoscope as a grey to blackish-brown swelling projecting into the vitreous.

Ætiology. Injuries, operations—extraction of cataract, iridectomy for glaucoma—tumours in the outer layers of the choroid; lastly in atrophic globes—only demonstrable with the microscope.

Treatment. The separation caused by injuries and operations produces no disturbance, and disappears in a short time spontaneously. When tumours are the cause—spontaneous appearance, disturbance of vision soon or late according to the situation—the earliest possible enucleation of the globe is urgently required.

Atrophia choroideæ is the final result of choroiditis exsudativa and is not amenable to any treatment.

Choroiditis exsudativa.

Subjective Symptoms. Flickering of objects, photopsia, metamorphopsia, micropsia, diminution of the light sense, scotomata relative and absolute (cf. Introduction), of all sizes and shapes. The diagnosis can only be made with the ophthalmoscope.

Ætiology. Most commonly, acquired syphilis. It is rarer to find it in congenital syphilis, but when it does occur the ophthalmoscopic appearances are to some extent diagnostic; the choroidal and retinal pigment is much involved, giving a picture like that of retinitis pigmentosa; choroiditis areolaris

and chor. anterior are also characteristic. General disturbances of nutrition—anæmia, scrofula, great heat, myopia, and diseases of the liver are among the causes. It is often associated with keratitis interstitialis—choroiditis anterior. In some cases no cause can be ascertained.

Treatment is directed against the causal disease and, in recent cases, must be energetically carried out. Inunctions and intramuscular injections of mercury may be used, even in non-syphilitic cases, provided there is nothing in the general condition of the patient to contra-indicate them; in addition, diaphoresis, bleeding, atropin, protection of the eyes from light, subconjunctival injections of 2–5–10 per cent. salt, or 1 to 2 per cent. potassium iodide solution.

℞ Iodi. puri. . . . . 0·01–0·02
Potass. iodid. . . . . 2·0
Aq. destill. . . . . 30·0
S. 0·5 to 1.0 cc.—m. 8 to m. 15 every second or third day.

Over-use of the eyes must be guarded against, even after the disease has run its course. In old cases treatment is merely palliative, and consists in the internal administration of potassium iodide, or in subconjunctival injections of 5 to 10 per cent. salt solution, or of 1 in 5000 hydrarg. cyanid.

℞ Hydrarg. cyanid. . . . . 0·01
Sod. chlorid. . . . . 0·1
Aq. destill. . . . . 50·0
S. 0·25—m. 4 to be injected subconjunctivally every day.

Choroiditis suppurativa.

Ætiology. (*a*) *Ectogenous* infection.

1. Perforating wounds; operations.

2. Ulcers of the cornea; infected prolapses of the iris.

3. Cystoid cicatrices, thin ectatic scars of the cornea with anterior synechiæ.

(*b*) *Endogenous* infection.

1. Septic embolism (*metastatic choroiditis*), most commonly

from pyæmia after confinement ; or in children from suppurative inflammation of the umbilicus, vaccination, gastro-enteritis, or more rarely, the acute infectious diseases.

2. In meningitis, especially cerebrospinal. It occurs chiefly in children, and has a relatively mild course.

3. In orbital cellulitis and thrombosis of the orbital veins.

I. *Acute form.* Œdema of the lids and conjunctiva, chemosis, cloudiness of the aqueous, hypopyon, frequently iritis. There is much pain and fever, and it may end in panophthalmitis and phthisis bulbi, or in atrophia bulbi.

Treatment. Only palliative for the pain. Hot fomentations, narcotics ; when panophthalmitis is commencing, deep incisions, in order to evacuate the pus and to relieve the intraocular tension ; enucleation.

II. *Chronic form* (*Pseudoglioma*, amaurotic cat's eye), occurs almost exclusively in children, and is characterised by its chronic course, the globe remaining pale, the iris normal or later atrophic, and the aqueous and lens clear. From the vitreous a yellow grey reflex is observed, which is frequently mistaken, especially in children, for an intraocular tumour (glioma). In the differential diagnosis the intraocular tension is of chief importance ; it is usually diminished in choroiditis suppurativa chronica, but normal or increased in glioma. In addition pseudoglioma leads to shrinking and diminution in size of the globe, while glioma perforates it and grows externally. Lastly glioma occurs only in the first four or five years of life.

Treatment. In doubtful cases the globe should be removed ; otherwise expectant treatment may be adopted, enucleation being proposed only when there are repeated attacks of inflammation or pain.

Detachment of the Choroid. (Cf. Ablatio choroideæ.)

Hæmorrhage into the Choroid.

Ætiology. Injuries ; or spontaneously in high grades of myopia and in the progressive form.

Treatment aims especially at the avoidance of congestion—rest, laxatives ; absorption may also be promoted by the internal administration of potassium iodide, diaphoresis, subconjunctival injection of 5 to 10 per cent. salt solution, or 1 to

2 per cent. dionin; or dionin in powder as an insufflation, or in 5 to 10 per cent. solution as an instillation.

Rupture of the Choroid. A consequence of contusions of the globe. It is only visible with the ophthalmoscope, but is often at first hidden by hæmorrhage in the vitreous and retina.

Treatment. Nil.

Tuberculosis of the Choroid.

1. *Disseminated or miliary.* Chiefly of importance as supporting or rendering certain the diagnosis of general miliary tuberculosis, of which it is a symptom.

Treatment. Nil.

2. *Solitary tubercle* is very rare, and occurs chiefly in young patients, associated with tuberculosis of the brain. It may, however, be the only focus in the body. The eye is always lost, and therefore enucleation should be performed as early as possible.

Tumours of the Choroid.

(*a*) *Malignant. Melano- and leuco-sarcoma.*

Stage I. Only visible with the ophthalmoscope as a tumour projecting into the vitreous, with a detachment of the retina over it. If the tumour itself is not visible under the retina or as metastases in other parts of the fundus, it is necessary to transilluminate the eye, in order to substantiate the diagnosis. Spontaneously arising detachments of the retina situated in the upper half of the fundus are always suspicious. The intraocular tension sometimes gives important information, since it tends to be diminished in simple serous detachment, but normal or increased in detachment from a tumour.

Subjective symptoms: Defect in the field of vision and diminution of visual acuity as in detachment of the retina.

Stage II. Increase of tension. Symptoms of acute glaucoma, especially severe pain. Ophthalmoscopic examination is usually impossible on account of the cloudiness of the media, but a detachment of the retina may be observed as a grey reflex behind the lens. Later, the lens becomes opaque—cataracta glaucomatosa. If the eye was already amaurotic, before the attack of acute glaucoma came on, this is in favour

of the presence of a tumour, since the sequence of events is the reverse in primary glaucoma.

Stage III. Breaking through of the tumour externally, either at the periphery of the cornea, or along the vortex veins or ciliary vessels ; a dark prominence appears at the affected spot. It may also travel along the optic nerve, in which case exophthalmos occurs. The pain now becomes less, and the tension normal.

Stage IV. General dissemination.

Treatment. Enucleation at the earliest possible moment. In Stage III. exenteration of the orbit.

Metastatic Carcinomata also occur and in the case of metastasis from carcinoma mammæ may have an adenomatous structure. Angiosarcomata—endotheliomata and peritheliomata—may also be found, and are diagnosed and treated as described.

Treatment. Enucleatio bulbi.

(*b*) *Benign.* Cavernous angiomata (very rare).

THE RETINA AND OPTIC NERVE

The diagnosis of the diseases of these structures is only possible with the ophthalmoscope, and the larger text-books must be referred to for details. A short description of the ophthalmoscopic appearances would be valueless to the unpractised, while to enter into details would cause this book to exceed its limits.

Ablatio retinæ (*Detachment of the Retina, Amotio retinæ*) is caused by serous fluid, blood, tumours, or the cysticercus.

Ætiology. Cicatrisation after perforating wounds or operations, fluidity of the vitreous, shrinking of the vitreous after iridocyclitis, choroiditis—in these cases, on account of the opacities of the media, the separation is not usually visible and can only be proved to exist by testing the projection of light. Myopia; separation by pressure from beneath—tumours, cysticercus, choroidal exudates, and hæmorrhages.

Subjective Symptoms. Visual disturbance: metamorphopsia, photopsia, contraction of the field of vision. The usual serous form of detachment occurs most commonly in the lower half of the globe, so that patients complain that they see only the lower half of objects.

Treatment. In spite of the many measures proposed, treatment is of little avail in this grave malady, and even when improvement is obtained it is too often merely transitory. Of chief importance, in order to prevent extension of the detachment, are complete rest in bed, light diet, and the use of purgatives. An attempt is made to induce the retina to become re-applied by keeping up pressure on the eye with a bandage; or by subconjunctival injections of 2-5-10 per cent. salt solution, 1 cc.—m. 15 daily with the addition of 1 per cent. cocain, eucain, or 0·1 per cent. acoin, or—

℞ Iodi. puri. . . . . 0·01–0·02
Potass. iodid. . . . . 2·0
Aq. destill. . . . . 30·0
(Panas),

or 2½ per cent. isinglass solution with 2 to 3 per cent. salt solution (de Wecker); 20 per cent. injection of salt solution, with puncture of the sclera with the thermocautery at the site of the detachment, has been practised, followed in the next week by Heurteloup's artificial leech to the temple, and so on in alternate weeks (Dor).

More energetic measures are: Scleral puncture at the situation of the detachment and drawing off of the subretinal fluid; cutting through the membranes in the vitreous and incising the separated retina by Deutschmann's method; injection of the vitreous of rabbits. The two latter methods are complicated, uncertain, and only to be employed by those specially skilled in operations on the eye.

Amblyopia = weak vision incapable of being improved by glasses. It results either from opacities of the cornea, lens, or vitreous, or from lesions of the light perceiving apparatus—the retina, with which may be included the choroid, since it partly nourishes it, and the optic nerve. Finally, amblyopia may depend on some cause which eludes our present means of examination — functional disease. To this latter group belongs:

Congenital amblyopia. Often associated with other congenital anomalies—coloboma of the iris and choroid, persistent pupillary membrane, astigmatism, etc. Unilateral amblyopia results in strabismus, bilateral in nystagmus.

No *treatment*.

Amblyopia ex anopsia is a consequence of a hindrance to vision occurring in early childhood—congenital cataract, opacities of the cornea, etc.

Treatment. Specially good results are obtained in cases of cataract, the removal of which, in earliest childhood, is not only possible, but urgently indicated. The amblyopic, often squinting eye, must also be exercised by covering up the other, so as to improve the functional power of the retina.

Amblyopia from central causes. Transitory, or progressing to total blindness (Amaurosis.)

Hysterical Amblyopia and Amaurosis. Usually only in hysteria with disturbances of sensation, and more marked on the same side as these. Field of vision concentrically or spirally narrowed, the contraction rapidly increasing during the course of the examination—exhaustion reaction. Frequently at the same time diminution of the light or colour sense.

Diagnosis. Absence of demonstrable changes in the eye to explain the weakness of vision, lack of agreement of the symptoms among themselves, great alterations in the acuity of vision and extent of the fields at different examinations, confidence in moving about, in spite of considerable narrowing of the fields and diminution of the visual acuity. The pupillary reflex is preserved, even in total blindness.

Ætiology. It usually occurs in young women, being of psychic origin ; sometimes there is a history of injury.

Treatment. The cause must be attacked—hysteria, neurasthenia. Injections of strychnin nitrate, ½ to 1 per cent.—0·5 cc. (m. 8) every second or third day into the temple. The constant current—2·5 milliampères for 3 to 6 minutes—either with the electrodes on the temple, or with one on the nape of the neck and the other on the eye. It is immaterial whether the anode or kathode is used.

Internally : arsenic, iron, or large doses of sodium iodide.

℞ Sod. iodid. . . . . 15·0
Sod. bromid. . . . . 5·0
Aq. destill. . . . . 200·0
Sig. 3 to 6 tablespoonfuls daily. (Pagenstecher.)

Uræmic Amaurosis. A transient blindness without retinitis in nephritis. Loss of vision progresses rapidly, and is complete within a few hours ; after one or several days the sight is restored again. The attack is associated with dyspnœa, headache, vomiting, loss of consciousness, and convulsions. The reaction of the pupil to light is preserved.

Treatment. That of uræmia—hot baths, enemata with chloral hydrate ; bleeding behind the ear.

Amaurosis fugax (Scotoma scintillans, Teichopsia). Along with a feeling of giddiness a flickering appears before the eye, which passes on to complete amaurosis, lasting from ¼ to ½ an hour ; it is followed by headache, and a sensation of exhaustion and pressure in the head. The flickering takes the form of fiery zig-zag lines ("fortification spectra"), and may be hemianopic, in which case the accompanying and subsequent headache is always on the opposite side.

Ætiology. Neurasthenia, migraine, disturbances of digestion —sometimes comes on after certain foods.

Treatment. The attacks may be combated with caffein citrate, 0·2 grm. (gr. 3) per dose, with which phenacetin 0·3 grm. (gr. 5), or antipyrin 0·5 grm. (gr. 8) may be combined ; or 15 to 20 drops of validol may be given, and repeated if necessary after five minutes.

℞ Menthol valerian. . . . . 5·0
Aq. destill. . . . . 25·0
Syr. aurant. . . . . 30·0

Amblyopia toxica. The most important toxic agents are : tobacco, alcohol, lead, carbon-monoxide gas, carbon bisulphide, anilin, antipyrin, quinine, filix mas, iodoform, salicylic acid ; also some infectious diseases, especially influenza, rheumatism, and syphilis.

The symptoms are those of retrobulbar neuritis : central or paracentral scotomata * especially for red and green, chiefly in

* The presence of a central scotoma may be suspected when, with relatively good vision for distance, near vision is disproportionately diminished. When the visual acuity is lowered from opacities of the media, exactly the reverse obtains. Even small central scotomata may be demonstrated by requesting the patient to fix a white spot on a black background at the distance of about 1 metre ; spots of red and green of about ½ to 1 cm. diameter are then brought inwards towards the fixation point from different directions, and the patient, who names the colours correctly in the periphery of his field, states whether the colour changes as it approaches the white spot, and, if so, at what point this occurs. The colours used should be as pure as possible, but not completely saturated, and are pasted on to strips of black cardboard. In relative scotomata red seems to become darker and more brown ; green, on the other hand, clearer and rather grey. In absolute scotomata the test object appears to be black in the case of red, and dark grey in the case of green.

alcohol and tobacco amblyopia; peripheral contraction of the field of vision—quinine, salicin, filix mas; day-blindness. The final result is either cure or atrophic degeneration of the papillo-macular bundle—the latter being shown by grey discoloration of the temporal half of the disc.

Treatment. Above all, avoidance of the toxic agents. In *acute* poisoning soda tartarata 10·0 to 20·0 grms. (dr. 2½ to dr. 5) in order to promote elimination of the poison by the kidneys. In poisoning by gases: venesection 2·0—4·0 grms. per kilo (about oz. ¼ to oz. ½ per 10 lbs.) of body weight, with subsequent injection of double that amount of 0·6 per cent. salt solution. Aftertreatment; strong coffee or cognac, inhalations of amyl nitrite.

In *chronic* poisoning—especially by alcohol and tobacco. These must be absolutely given up; according to some authors, however, not suddenly. Energetic warm rubbing and massage, mild purgatives, injections of strychnin nitrate 0·005—0·01 grm. (gr. $\frac{1}{12}$ to gr. $\frac{1}{6}$), potassium and sodium iodide internally, the constant current. In drunkards, improvement of the heart's action.

In carbon bisulphide poisoning: cessation of exposure to the fumes, tonics, syrup, ferri iodidi. As a prophylactic measure, the use of inhalers.

In quinine amaurosis: amyl nitrite, digitalis, potassium iodide.

In lead poisoning: prophylaxis, potassium iodide, diaphoresis.

In methyl alcohol poisoning—from the use of Jamaica ginger, wood-spirit, peppermint essence, or in workers in these substances: injections of pilocarpin, large doses of potassium iodide, strychnin, iron.

N.B. In carbon bisulphide and methyl alcohol poisoning cerebral symptoms are the first to appear—vomiting, malaise, lassitude, giddiness—while blindness occurs later. The prognosis is also worse than in ethyl alcohol or nicotin poisoning.

Anæmia retinæ. Causes: embolism of the central artery of the retina, large losses of blood, paracentesis abdominis for

ascites, collapse stage of cholera, quinine or potassium bromide poisoning, fainting.

Treatment: according to the ætiology.

Anæmia nervi optici. In embolism of the central artery and general anæmia.

Treatment: that of the cause.

Asthenopia.

1. *Accommodative asthenopia* in hypermetropia. After using the eyes for a short time for near vision objects become indistinct and misty.

Treatment. The prescription of glasses for near work.

2. *Muscular asthenopia*, in the higher degrees of insufficiency of the interni. Before becoming actually indistinct, near objects begin to move on one another; the trouble disappears at once if one eye is closed.

Treatment. Prisms with their bases inwards—not more than 4 to 6 degrees before each eye; or tenotomy of the rectus externus.

3. *Functional asthenopia* (hysterical). Pains in the lids, eyeball, and head after using the eyes in near vision for a short time, or continual sensitiveness to light (*kopiopia hysterica*). Errors of refraction and of muscular balance must naturally be excluded by thorough investigation.

Treatment. Chiefly psychic: also electricity, especially the constant current to the eye or forehead.

Atrophia nervi optici. For the ophthalmoscopic appearance in the different forms—post-neuritic, primary, descending, and post-retinitic—the text-books must be consulted.

The field of vision for colours is contracted earlier than that for white and concentrically, whereas in glaucoma contraction for white proceeds along with that for colours, and is more pronounced on the nasal side.

Ætiology. Optic neuritis (intraocular or retrobulbar), neuroretinitis, choroiditis, retinitis; descending degeneration after compression of the optic nerve or tract, especially in the brachycephalic form of skull; hydrocephalus, multiple sclerosis, tabes, progressive paralysis, alcohol, lead, nicotin, syphilis, diabetes; after chills and febrile diseases, loss of

blood; embolism of the central artery, injuries of the nerve.

Treatment. First and chiefly that of the primary disease. For the disease of the nerve itself: tonic regimen. The constant current with a strength of 2 milliampères is also used, the kathode being applied to the closed lids, and the anode to the back of the neck; after a few minutes the current is reversed. Injections of strychnin and hydrotherapy may also be employed.

Internally: potassium or sodium iodide or rubidium iodide, which has the least tendency to produce iodism, but is expensive; or argent. nitratis 0·01 grm. (gr. $\frac{1}{6}$) in a pill—1 or 2 pills three times daily. Inunctions of mercury are of very doubtful value in the atrophy which ensues in the later stages of syphilis—especially in tabes; if used at all in these cases it is necessary to keep careful watch on the visual acuity, and to discontinue the inunctions at once if it is becoming diminished.

The best results are obtained in post-neuritic atrophies, the worst in primary atrophies associated with cerebro-spinal diseases—tabes, multiple sclerosis and progressive paralysis.

Colour-blindness (*Daltonism*).

(*a*) *Congenital*, may be total, for all colours, or partial for one pair of complementary colours—red-green, or blue-yellow (violet). The latter is very rare.

Although the condition is incurable, its detection is important, especially in railway servants and seamen. In order to make a certain diagnosis it is always necessary to use several methods of testing. The candidate must not be asked to name the colours of the objects placed before him, for on the one hand, many colour-blind persons can do this quite correctly by observing the differences in luminosity which have always been familiar to them; on the other hand, many individuals with normal colour sense are unable to give the proper names to colours.

1. The simplest method is with *Holmgren's wools*, of which it is most important to obtain a proper assortment—such as

is sold by Frl. Letty Oldberg of Upsala, or S. Dörffel of Berlin. The method of using them is as follows :—

(*a*) *Test for Green.* The blue-green and yellow-green wools (packets ii. and iii.) are not used at first, and are put aside. The remaining strands are laid in a promiscuous heap upon the table. The surgeon then picks out and shows to the examinee five green bundles without naming them ; he retains the light sea-green bundle and mixes the rest with the heap ; he now requests the candidate to pick them out again, warning him carefully at the same time only to choose wools of the same *colour*, and not of the same *luminosity*. If the colour vision is good, he does this with little or no difficulty, while if it is defective, he selects also grey-brown, grey-red, or pure grey wools. He is then asked once again if he is certain that all have the same *colour*, and if there is any doubt about it the test is repeated.

In order to obtain further confirmation, the so-called *purple* (*rose-pink*) *test* is undertaken in addition. It is carried out in the same manner as the last, except that purple and rose-pink bundles are used instead of green, a clear shade of these acting as the test bundle. Red-green blindness is shown by the choosing of blue-grey, blue-green, or even blue or violet shades ; violet blindness, by the choosing of brilliant red or yellow-red.

If this test is performed rapidly and without errors the examinee is certainly not colour-blind, nor is his colour sense even weak. If, however, the characteristic mistakes have been made it does not necessarily follow that he is colour-blind. Other confirmatory methods must be employed ; for instance, confining our attention to the Holmgren wools, a brownish grey may be presented which will usually be matched with green shades by the colour-blind.

Clumsy *simulation* is easy to recognise by this method, since colours quite unlike, and not liable to be mistaken by the colour-blind, are laid together—*e.g.*, brilliant orange and green. An intelligent simulator, however, who has been trained for the test, may escape detection.

Dissimulation is hardly possible by the above method, provided that sufficient confusion colours are at disposal.

To demonstrate violet (blue-yellow) blindness, the green packets ii. and iii. are mixed with one another; a yellow-green and a blue-green bundle are then laid separately, and the candidate is requested to sort out the heap to correspond with these two shades.

2. Instead of the wools, coloured powders, pencils, papers, etc., may be used on the same principle.

3. Special apparatus may be used for the comparing of colours (Hering, Nagel, Eversbusch, etc.).

4. *Stilling's pseudoisochromatic tables* have much the same value as Holmgren's wools. A table in which the letters can be recognised by any one is commenced with, and the others used afterwards. Exact instructions are given with each set.

5. *Pflüger's method*, in which contrast is employed is preferable. It is especially useful as a confirmatory test in combination with 1, 2, or 6. Black and grey letters are painted upon coloured backgrounds and covered with one to three layers of thin tissue paper. To a person with normal colour sense they appear of the colour complementary to the background, while to the colour-blind they are not legible, nor usually even visible. A green card covered with a single layer of tissue paper is first used, on which the letters should be easily read; then an orange-yellow card, also covered with a single layer, is presented, which should be read by those with normal colour sense and by the red-green blind. Next, the purple and dark-red cards are employed and these at once discover the defect; the large letters are seen through the tissue paper, as lighter and darker marks, and may be partially read, but the smaller are for the most part not seen at all. In this manner deficiency of the colour sense is proved, but red is not differentiated from green blindness.

6. *Nagel's tables* are also useful in the detection of colour-blindness; full instructions are provided with them.

(*b*) *Acquired Colour-blindness.* A frequent symptom of diseases of the retina, of the central terminations of the optic tract, and more especially of atrophy of the optic nerve in cases with considerable loss of visual acuity. The perception

of green and red are first lost, next yellow, and finally also blue.

Treatment. That of the primary disease.

Commotio retinæ (Berlin's opacity). A transitory, partial, milky opacity of the retina, after contusions with blunt bodies.

Cysticercus subretinalis. Diagnosis is only possible in recent cases in which a sharply circumscribed bladder is visible through the detached retina. An attempt should be made to remove it, but the operation requires considerable technical skill. Later, much opacity of the vitreous, iridocyclitis, cataracta complicata, and total detachment of the retina occur, and the final result is atrophy of the globe. The eye becomes blind and liable to painful inflammatory attacks, and nothing remains but enucleation.

Daltonism. (See Colour-blindness.)

Day-blindness.* Defective visual acuity during the day, which improves relatively with increasing darkness.

Ætiology. (*a*) Central opacities of the media—corneal cicatrices, occlusio pupillæ, central cataract.

(*b*) Retrobulbar neuritis (*q.v.*).

(*c*) Idiopathic. In individuals who have lived for years in darkness (criminals, etc.).

Treatment. In central corneal opacities: tattooing. In retrobulbar neuritis, see under Neuritis. In idiopathic cases: the use of dark glasses, which are gradually made lighter so that the patient slowly becomes able to bear brighter illumination.

Detachment of the Retina. (See Ablatio retinæ.)

Embolism of the Central Artery of the Retina. Sudden blindness, of which the patient can give no explanation. The ophthalmoscopic appearances are characteristic (see text-books). In embolism of a branch of the central artery a sector of the field of vision is lost, corresponding to the area of retina supplied by the affected vessel.

* So much confusion has arisen in ophthalmological literature in the use of the terms "nyctalopia" and "hemeralopia" that we have thought it better to use the terms day-blindness for what the author calls nyctalopia, and night-blindness for what he calls hemeralopia, since these names are not liable to be misunderstood.—Trs.

Treatment. In recent cases: Paracentesis, or energetic massage of the eye with the tip of the finger laid upon the closed lids; sweeping circular movements or perpendicular pressure on the globe should be carried out, but pain should not be produced. There is, however, little prospect of success. In old cases, when the nerve has become atrophic, treatment is useless.

Glioma retinæ. Only in young children. Cases are usually brought to the surgeon because the parents have noticed a grey reflex from the pupil; sometimes, however, not until the tumour has perforated the globe. For the differential diagnosis from pseudoglioma see Choroiditis suppurativa.

Treatment. Thorough exenteration of the orbit, including the periosteum; if neighbouring structures are involved these must also be attacked. This is a major operation which should only be performed in institutions with skilled assistance.

Hæmorrhages in the Retina. For the diagnosis and ophthalmoscopic appearances, the larger text-books must be consulted.

Ætiology. Injuries, sudden lowering of the intraocular tension (in operations for glaucoma), disturbances of the circulation—anomalies of menstruation, thrombosis of the central vein, ligature of the carotid, whooping-cough, asphyxia, epilepsy; forceps delivery, altered conditions of the blood or vessel walls—sepsis, jaundice, endocarditis, anæmia, after profuse loss of blood (hæmorrhage from piles, metrorrhagia, hæmatemesis), malaria, cachexia, diabetes, hæmophilia, scurvy, arteriosclerosis, myopia, retinitis. It also occurs without demonstrable cause in young people between ten and twenty years of age.

Treatment. In addition to combating the causal condition, sorbefacients are used: diaphoresis, subconjunctival injections of salt solution and iodipin, instillations of dionin (contra-indicated in arteriosclerosis), preparations of iodine internally, purgatives. (Cf. Treatment of Vitreous Opacities.)

Injuries of the Optic Nerve. Direct wounding by stabs, bullets, or penetrating foreign bodies, manifests itself by

sudden and incurable partial or complete blindness. The ophthalmoscopic appearances differ according to whether the wound is behind or in front of the point of entrance of the central vessels—about 1½ cm. behind the globe. In the former case the fundus is at first normal, but later presents the picture of primary optic atrophy ; in the latter case the appearances are those of embolism of the central artery with total anæmia of the papilla. In wounds close behind the globe —it may be with abruption of the optic nerve—copious hæmorrhage is found at first in the retina, replaced later by pigmentation and new formation of connective tissue upon and in the retina (Retinitis proliferans). This occurs especially after bullet wounds.

If the optic nerve is indirectly affected by the injury, as in falls upon the head, fractures of the base or at the optic foramen, and contusions, the cerebral symptoms of concussion or fracture of the base are present combined with partial or total amaurosis.

In these cases treatment is of no avail and the blindness is incurable.

Kopiopia hysterica. Speedy exhaustion on using the eyes for near work, with pains in the lids, globe, and head, and often continual sensitiveness to light. (Cf. Asthenopia nervosa.)

Neuritis optica (*α*) *Intraocular Papillitis.* Disturbance of vision which may reach the degree of total blindness. Sudden, transient and repeated obscurations are characteristic, and there may sometimes be defects in one half of the field of vision.

Ætiology. Most commonly cerebral disease—tumor cerebri, basal meningitis, cerebral hæmorrhage, thrombosis of the cerebral sinuses (associated with chemosis and exophthalmos), hydrocephalus (especially in children), tumours of the neighbouring air sinuses ; orbital diseases with pressure on the optic nerve—tumours, cellulitis, periostitis at the optic foramen ; anomalies of menstruation and lactation ; sympathetic ophthalmia, acute infectious diseases—typhoid, pneumonia, variola, scarlatina, morbilli, influenza ; diabetes, scrofula, anæmia, chlorosis, syphilis, chill, lead-poisoning, injuries, hereditary predisposition.

Intraocular neuritis may take the form of choked disc, especially in intracranial tumours.

Treatment. In the first place the causal disease must be combated. For the local affection the chief measures are protection from light and rest for the eyes, blood letting in the temple or behind the ear, sorbefacients—diaphoresis, potassium iodide, mercury, subconjunctival injections of salt solution; in commencing atrophy the constant current to the eye (1 to 2 milliampères), injections of strychnin (0·005 to 0·01 grm.,—gr. $\frac{1}{12}$ to gr. $\frac{1}{6}$, two to three times per week).

(*b*) *Retrobulbar.* Alcohol, tobacco, or lead-poisoning (toxic amblyopia), diabetes, syphilis, chill, multiple sclerosis, febrile diseases, orbital cellulitis, suppuration in the frontal sinuses.

The characteristic symptoms are diminution of visual acuity, day-blindness (relative improvement of vision with diminished illumination), and relative or absolute central or paracentral scotomata for red and green. (Cf. Amblyopia toxica.)

N.B. In all cases in which scotomata are found the urine must be examined for sugar.

The *prognosis* is favourable if treatment is undertaken in good time.

Treatment. Attention must be given to the cause, and in addition protection from light, strychnin injections, hydrotherapy and resorbents (diaphoresis and potassium iodide) are indicated. In alcohol and nicotin amblyopia, these poisons must be entirely abstained from, but according to some authors they should be given up gradually. (Cf. also the treatment of Amblyopia toxica.)

Night-blindness. A disproportionate diminution of otherwise good visual acuity with lessened illumination. The idiopathic form (*vide infra*) is often combined with the occurrence of triangular spots of conjunctival xerosis in the area of the palpebral fissure.

Ætiology. 1. Peripheral opacities of the cornea or lens.

2. Diseases of the light-sensitive apparatus, especially in its peripheral parts (Torpor retinæ). It is very characteristic of retinitis pigmentosa, and occurs also in peripheral choroiditis and detachment of the retina.

3. Idiopathic night-blindness occurs usually in winter in poorly nourished individuals, especially if they are exposed to long-continued glare (snow-shovellers, etc.). Pregnancy, alcoholism, malaria, jaundice.

Treatment.

ad 1 and 2. See the corresponding headings.

ad 3. Protection of the eyes from light, or keeping them entirely in the dark by means of a black bandage and living in a dark room. Improvement of the general nutrition with iron, quinine, and the free use of cod-liver oil in all possible preparations or of extract. hepatis vitelli (calves' liver), 3 tablespoonfuls daily in bouillon. To improve the sensitiveness of the optic nerve and retina : the constant current and injections of strychnin. The prognosis is always favourable.

Retinitis. Diagnosis is only possible with the ophthalmoscope.

The subjective symptoms consist in disturbance of vision of various degrees. In the slightest cases the complaint is only of mistiness or the seeing of black spots, or where there are circumscribed exudates of fixed scotomata, which cause much annoyance. The course is chronic.

Ætiology. Most cases are the result of general disease, and especially of the chronic forms of nephritis. Other causes are diabetes, syphilis, and arteriosclerosis, or more rarely sepsis and leukæmia. It may be sympathetic. A local cause is said to be severe dazzling ; for instance, on looking at partial eclipses of the sun without dark glasses, or at an electric arc light (in engineers, etc.). It is also part of the changes which take place in myopic fundi.

The *treatment* must therefore be chiefly directed towards the general disease. Syphilitic retinitis gives the best prognosis, while on the other hand retinitis albuminurica is of the gravest significance, not only in itself, but also for the life of the patient.

The local *treatment* consists in rest for the eyes and protection from light ; for the congestion, saline purgatives and the withdrawal of blood from the temple or behind the ear ; to promote absorption of exudates in the retina and vitreous—

diaphoresis, mercurial inunctions, preparations of iodine, subconjunctival injections of common salt or iodide (cf. Opacities of the Vitreous). The diet should be plain, and alcohol is to be avoided.

Retinitis pigmentosa is not a true inflammation, but a simple pigmentary degeneration, resulting in atrophy of the retina and optic nerve.

The symptoms consist in slowly progressive diminution of the visual acuity, and in night-blindness, which reaches such a degree that the patient can no longer go about alone in the twilight. Nystagmus is also common, but the patient himself is not conscious of any movement in the surrounding objects. The disease is bilateral, and is either congenital in origin or commences in childhood ; it is often hereditary, and in a large percentage of cases consanguinity of the parents can be proved.

Treatment is without effect, and blindness is inevitable in advancing age—fifty years or so. As a placebo potassium iodide may be given internally, or injections of strychnin under the skin of the temple (0·005 grm. $\frac{1}{12}$ gr., two or three times weekly), or the constant current.

Thrombosis of the Central Vein of the Retina.

Ætiology. Arteriosclerosis, hypertrophy of the right ventricle, emphysema of the lungs, orbital cellulitis often caused by erisypelas.

Subjective symptom. Sudden and considerable diminution of vision in thrombosis of a branch, or blindness. It results in optic atrophy.

Treatment. Only palliative ; laxatives, iodine preparations.

Tumours of the Optic Nerve. These may arise primarily in the sheaths or neuroglia of the nerve—fibromata, sarcomata, myxosarcomata ; or the nerve may be secondarily involved by the extension of intraocular tumours.

At first there may be no symptoms, or there may be a diminution of visual acuity not explained by any changes found with the ophthalmoscope. Later, however, optic neuritis with much venous obstruction will be discovered or a post-neuritic atrophy. As the tumour grows exophthalmos is

added, the globe being usually pushed straight forwards and but little to one or other side, a point of distinction from other orbital tumours. Retention of the ocular movements for a comparatively long time with early loss of sight, the ophthalmoscope showing post-neuritic or primary optic atrophy, is also characteristic.

In secondary tumours of the optic nerve the diagnosis is often made easier by the fact that the primary tumour is visible.

In the latter form the *treatment* consists in exenteration of the orbit which, however, is hopeless if the interior of the skull or the neighbouring air sinuses are already involved.

Primary tumours of moderate size may sometimes be extirpated with retention of the eyeball by temporarily dividing the muscles, rolling the tumour forwards and excising it, or by Krönlein's method of temporarily resecting the outer wall of the orbit. If, however, in the course of the operation it is found that the tumour has involved the globe or extensively infiltrated the orbital tissues, exenteration of the orbit holds out the only prospect of success.

Atony of the Lacrymal Sac. Dilatation of the lacrymal sac with loss of elasticity of its walls in consequence of long-continued blennorrhœa. Cure follows spontaneously when drainage of the tears is restored, or may be hastened by massage and galvanisation. If, however, the atony is of high degree the sac should be excised.

Blennorrhœa of the Lacrymal Sac (sive *Dacryocystitis catarrhalis*). An inflammation of the mucous membrane caused by stagnation and decomposition of the secretion, the result of: 1. Inflammatory swelling of the nasal mucous membrane—acute or chronic catarrh, scrofulous, or syphilitic rhinitis; 2. Cicatricial contraction (rhinitis atrophica) with obliteration of the lacrymal duct; 3. Tuberculous, lupous, or syphilitic ulcers of the nasal mucous membrane; 4. Tumours, especially polypi, in the nasal cavities; 5. Epithelial adhesion in the nasal duct in infants. A flat bridge of the nose forms a predisposing cause of the affection.

Symptoms. Lacrymation; a tumour, caused by dilatation of the lacrymal sac, is visible at the inner angle of the eye (atony, hydrops sacci lacrymalis), and if this is pressed upon, mucus or pus is evacuated through the puncta or lacrymal duct; on passing a Bowman's probe a stricture or occlusion of the duct is demonstrated.

The *course* is chronic.

Sequelæ. Chronic conjunctival catarrh; blepharitis with its consequences—eczema of the lids and ectropion. The condition is dangerous to the eye itself, inasmuch as abrasions of the cornea are liable to become infected. (Cf. Ulcus serpens corneæ.)

N.B.—In all cases of lacrymation, especially if unilateral, the lacrymal passages must be very carefully examined.

Treatment. Ad. 1 and 5, frequent forcible expression of the contents of the sac, with subsequent blowing of the nose. The sac will be found behind the internal tarsal ligament (tendo oculi), which can be easily made visible under the skin by stretching the lids from the temporal side. The sac should be syringed out at the same time with 1 in 4000 hydrarg. perchlor., 1 in 1000 to 5 in 1000 hydrarg. cyanat., 3 per cent. boracic, or ½ per cent. argent. nitrat. solution. In 1, the rhinitis must be treated. Only if these measures are without result should probing and syringing be resorted to, until the rhinitis is cured or the epithelial adhesion freed.

Probing is carried out as follows : The lower punctum, or if it is obliterated, the upper, is first dilated with the conical dilator ; this is first passed vertically into the punctum for 1 to 2 mm., and then brought round to the horizontal position, so that it points inwards and a little upwards and backwards ; it is then pushed on with a slight rotatory movement, but without force, until the bony resistance of the lacrymal bone is felt. A Weber's canaliculus knife is now introduced into the dilated punctum, and also passed along until it meets with bony resistance ; it is then brought into the vertical position, and, in so doing, the canaliculus is slit up. The incision should lie in the lid margin, or a little inwards towards the conjunctival sac. A slightly curved probe (No. 1 or No. 2) is now pushed along the groove to the bone without any force, and is then brought upright, so that its direction corresponds with the furrow between the cheek and the ala of the nose ; it is then slowly and cautiously passed downwards. In this manner information is obtained as to the presence and position of the stricture or occlusion. The use of force is always to be avoided ; if even the finest probe fails to pass, another attempt should be made on the following day, and only after repeated failures should extirpation or destruction of the sac be proceeded with. If, however, after one or repeated attempts the probe has been successfully passed through the stricture, it should be left in for about a quarter of an hour, and followed by thicker probes, so that the narrowed portion is gradually dilated. This treatment must be continued until lacrymation

has ceased, and the drainage of the tears has become quite free. When this stage has been reached probing is only performed at longer intervals (1 week to 1 month) so as to prevent the stricture from contracting again.

The lacrymal sac may be opened by an incision with a pointed bistoury in a line marked out as follows : The tendo oculi (internal tarsal ligament) is made prominent by stretching the lids in a horizontal direction, and a line is taken from its mid-point to the mid-point of a line drawn from the point of the nose to the outer orbital margin. The back of the knife is directed upwards, and when it strikes the bone its handle is raised, and its point pushed onwards ; in this manner the commencement of the lacrymal duct is entered. The wound is enlarged upwards and downwards, and the sac destroyed with the silver nitrate stick or caustic paste, or by scraping it out with a sharp spoon, and packing the wound with gauze.

Excision of the lacrymal sac achieves the same result more rapidly. It may be carried out by an incision made as above, or by carefully dissecting through the skin and muscle, layer by layer, dividing or leaving intact the tendo oculi as convenient. When the anterior wall of the sac is reached it is cautiously cleared from its surroundings, beginning always with the nasal side where it lies in the groove in the lacrymal bone, because it can be separated there easily and with little hæmorrhage. Bare bone should be felt and seen after its removal. The operation may be performed under cocain or with Schleich's infiltration anæsthesia. After the sac has been excised, a small sharp spoon should be introduced along a probe as far as possible down the duct, and the diseased mucous membrane scraped out. The wound is then sutured, pressure exercised upon the cavity with a tampon of iodoform gauze, and a bandage applied in order to obtain speedy adhesion and to prevent the collection of discharge. If there is no pain or fever the wound is dressed on the second or third day, and the stitches are removed on the fifth or seventh day.

If epiphora does not rapidly cease after excision of the sac the lower (palpebral) portion of the lacrymal gland must be

removed, or in the worst cases also the upper (orbital). Sometimes, in spite of all these measures, the epiphora still persists for a time.

Dacryocystitis (*D. plegmonosa*). A suppurative inflammation of the connective tissues around the lacrymal sac.

Symptoms. Redness, swelling and tenderness at the inner canthus with œdema around; fever, and sometimes conjunctival chemosis. At first increased resistance; later fluctuation and abscess formation. Perforation commonly occurs externally, but usually lower than in perforations of the sac itself; more rarely it breaks into the orbital tissues. The process may end at this stage, or recurrence may take place, or a fistula be formed.

Treatment. At its commencement an attempt may be made to prevent abscess formation by frequently pressing out the contents of the lacrymal sac, syringing it with antiseptic solutions, and applying a pressure bandage. Later, suppuration should be hastened by hot fomentations, and when fluctuation or pointing has occurred, a free incision should be made and the cavity plugged and drained. When granulation has taken place the sac, or its remains, may be excised.

Canaliculi. 1. *Stenosis and Occlusion* may be congenital or acquired. The latter usually result from injury in probing, or from incised or lacerated wounds at the inner canthus extending through the whole thickness of the lid. More rarely they are caused by concretions or foreign bodies—cilia, etc. Epiphora is the consequence.

Treatment. In stenosis: careful dilatation with the conical sound and slitting of the canaliculus.

In occlusion: removal of foreign bodies and concretions. If the obliteration is cicatricial, treatment can only deal with the troublesome epiphora by extirpation of the lacrymal gland.

2. *Concretions.* The neighbourhood of the punctum is much reddened and somewhat swollen, and on careful palpation a localised resistance is felt in the canaliculus. If the probe be introduced it comes upon an obstruction. On slitting or pressing upon the canaliculus a grey or yellowish-green granule

or a crumbling mass is evacuated, which consists of a partially calcified interlacement of fungus mycelium. Treatment, *vide supra.*

3. *Cystic dilatation* results from obliteration of the canaliculus at both ends, and is very rare. If it causes any annoyance the cyst may be extirpated.

Dacryoadenitis. Inflammation of the lacrymal gland. It arises spontaneously, or is combined with swelling of the parotids—mumps of the lacrymal gland—and either slowly retrogresses or suppurates and breaks through externally, leaving a lacrymal fistula. The course may also be chronic throughout, with localised indolent enlargement of the gland.

Symptoms. Swelling, tenderness, and œdema, especially in the outer half of the upper lid, which is reddened and pendulous. There is often œdema of the conjunctiva, or even exophthalmos, with enlargement and tenderness of the preauricular glands and fever. On palpation a painful, resistant tumour is felt under the upper orbital margin, and on everting the upper lid a red irregular prominence is visible ; the latter is important in distinguishing the condition from marginal periostitis of the orbit.

Treatment. Hot fomentations with diluted Burow's solution, mercurial plaster or ointment, potassium iodide, internally or in ointment. When perforation is imminent, the abscess must be opened, drained, and plugged.

Dacryops. A cyst-like dilatation of the ducts of the lacrymal gland. If it causes a troublesome feeling as of a foreign body in the upper fornix, it should be extirpated, the upper lid being everted whilst the patient looks downwards.

Epiphora. *Ætiology.*

1. Increased secretion of tears from some irritation of the first or second divisions of the trigeminal—light, cold, smoke, foreign bodies in the conjunctival sac, inflammations of the eye and its adnexa, diseases of the nose, neuralgia of the trigeminus, hysteria.

2. Imperfect drainage of the tears from incomplete closure of the lids—paresis or paralysis of the orbicularis, undue

shortness of the lids, ectropion, coloboma, eversion ; or from anomalies of the lacrymal passages—stenosis or stricture of the lacrymal duct.

The *treatment*, therefore, depends upon the cause. The conjunctiva and globe must be carefully examined for foreign bodies on the cornea and beneath the upper lid, and other irritations of the terminations of the trigeminal must be searched for. If this examination reveals no cause for the condition, the lacrymal passages should be probed and the nasal cavity investigated. For the further treatment see under the individual headings.

Eversion of the Puncta is only observed in the lower lid. It is a precursor of ectropion (*q.v.*) and results in epiphora, which again aids in converting the eversion into a true ectropion.

Treatment consists in slitting up the canaliculus (cf. Blennorrhœa of the Lacrymal Sac), and afterwards repeatedly separating any adhesions of the edges of the incision with a probe. Drainage is thus restored, and at the same time the eversion is combated by applying a bandage. (Cf. Ectropion.)

Fistula of the Lacrymal Sac may remain after wounds of the sac or after the perforation of a dacryocystitis. In the situation of the sac, or more frequently somewhat beneath it, an opening is found clothed with granulations and covered with a scab ; from this mucus or pus wells out, especially on pressing upon the sac. If it is doubtful whether the opening communicates with the sac, a coloured indifferent fluid (*e.g.*, milk) may be injected through the opening, or better, through the puncture, and its point of exit observed.

The *treatment* is tedious and often only successful after various methods have been tried. In the first place the condition of the lacrymal duct must be investigated by probing from the puncta (see treatment of Blennorrhœa of the Lacrymal Sac). If it is but little narrowed it may be gradually dilated with probes of increasing size. When drainage of the tears has been restored the fistula becomes functionless, and often closes spontaneously or after cauterisation of its walls and edges. If, however, this does not take place it may be scraped

or totally excised and the wound sutured or covered with a flap of the surrounding skin. Should it be found impossible to restore communication with the nose, the fistula should be enlarged, and the sac extirpated by scraping or excising its thickened wall.

Capillary fistula is an extremely fine, hardly visible, opening after dacryocystitis, presence of which is only indicated by the occasional appearance of a little tear-drop on the skin beneath the region of the lacrymal sac. The treatment is often tedious, and consists in cauterisation of the walls and edges, or if this is insufficient in excision and a plastic operation.

Lacrymal Duct: Stenosis, Stricture.

Causes. Ascending from the nose: simple inflammatory swelling of the nasal mucous membrane or cicatricial stricture after ulceration of it. Disease of the bony framework of the nose, especially after syphilis—saddle nose. Injuries from careless and forcible probing.

Symptoms. Epiphora, and when consecutive blennorrhœa of the lacrymal sac has occurred, tumor lacrymalis.

Diagnosis can only be made by probing and syringing from the puncta. (Cf. Blennorrhœa of the Lacrymal Sac.)

Treatment. Systematic probing, at first every day or every second day; when a passage has been established once a week or once a month, and afterwards at more considerable intervals. A permanent hollow style may also be inserted. After probing, the sac should be syringed out with antiseptics (boracic acid 3 per cent., hydrarg.perchlor. 1 in 4,000, hydrarg. cyanat. 1 in 1,000 or 1 in 500), and later with astringents (argent. nitrat. $\frac{1}{4}$ to $\frac{1}{2}$ per cent., protargol 1 to 10 per. cent). Syringing is performed with the so-called Anel's syringe, of which the canulæ are slightly curved and blunt pointed; like Bowman's probes, they are of different thicknesses.

If the stricture cannot be dilated, or if the duct is entirely obliterated, the sac should be extirpated or excised. (Cf. Blennorrhœa of the Lacrymal Sac.)

Lacrymal Gland. (*a*) *Atrophy.* In xerophthalmos from destruction of the ducts, the result of the great shrinking of the conjunctiva.

No treatment.

(*b*) *Inflammation.* (Cf. Dacryoadenitis.)

(*c*) *Dacryops, vide supra.*

(*d*) *Fistula.* Usually the result of wounds or the breaking through of a suppurating gland.

Treatment. Operative : a silk thread is armed with needles at its two ends, and both of these are entered through the fistulous opening and brought out at two spots near each other in the upper fornix. They are then tied together and left to cut their way out (Hulke).

(*e*) *Hypertrophy.* On everting, or often on merely lifting up the upper lid the irregular soft hypertrophied gland becomes visible under the conjunctiva in the outer third of the fornix. In chronic dacryoadenitis the enlarged gland is hard and sometimes somewhat tender.

Treatment. If at all troublesome iodine or mercury ointment may be applied to the skin over the gland.

(*f*) *Tuberculosis.* Painless, palpable enlargement of the gland. It usually spreads from the conjunctiva.

Treatment. Thorough extirpation.

(*g*) *Tumours.* Adenomata, carcinomata, cysts, sarcomata. Extirpation from the fornix conjunctivæ or through the skin.

Lacrymal Sac. *Atony. Vide supra.*

Blennorrhœa. Vide supra.

Hydrops. In atonic dilated lacrymal sacs the contents, which are at first turbid, become gradually clear ; this condition is designated Hydrops. The sac should be extirpated or excised on account of the danger of infection of the eye.

Tuberculosis spreads from the conjunctiva or nose. The sac is thickened, soft, often ulcerated and filled with spongy, pale granulations.

Treatment. Thorough extirpation.

Puncta.

1. *Eversion* (*vide supra*).

2. *Obliteration* or *narrowing.*

(*a*) From injury to the mucous membrane by careless probing.

(*b*) From cicatrices in the neighbourhood (lid-margins, etc.).

Sequelæ. Epiphora. If only one is affected the drainage is but little interfered with.

If the punctum is merely narrowed it may be carefully dilated with the conical sound and the canaliculus then slit up. If both puncta are occluded, the epiphora can only be got rid of by extirpating the lacrymal gland, and even this is not necessarily followed by cure.

Stenosis and Stricture of the Lacrymal Duct. (See Lacrymal Duct.)

Stenosis and Stricture of the Canaliculi. (See Canaliculi.)

Tumor lacrymalis. A swelling near the inner canthus caused by an ectatic lacrymal sac. It is the result of blennorrhœa of the sac, and mucoid discharge may be evacuated into the conjunctival sac or into the nose on pressing upon it with the finger. It is therefore a symptom of blennorrhœa of the sac, especially if combined with atony or hydrops.

THE ORBIT

Two symptoms are of great importance in diseases of the orbit and of the orbital contents ; exophthalmos and limitation of the movements of the globe.

By the combination of these two symptoms with others certain clinical pictures are formed by which the practitioner is guided to a diagnosis, and at the same time to a proper line of treatment. The latter will, therefore, be approached from this point of view. Some matters of importance in the differential diagnosis will also be discussed.

1. **Inflammation of the lids, the predominating feature.**

A. If no sufficient cause for this is found in the lids themselves—hordeolum, blepharitis, ersyipelas, etc. (cf. Œdema of the Lids)—the orbital margin must be carefully palpated, the symmetrical spot on the other side being felt with the other hand at the same time for purposes of comparison. If a localised, more or less tender, hard thickening of the bony margin is found the condition is **Periostitis of the Orbital Margin.** The treatment will be guided by the ætiology.

1. *Trauma.* In this case ecchymosis or a wound will be present at the spot or in its neighbourhood. If there is no wound cold compresses with water, lead lotion or aluminium subacetate solution (1 to 2 per cent.) should be employed with ungt. hydrarg. to promote absorption. If there is an open wound it must be dressed antiseptically with iodoform or airol gauze or ointment or, if there is much swelling, with moist applications of aluminium subacetate solution. Clean incised wounds may be stitched.

2. *Syphilis.* Occurs also in children from congenital

syphilis. The course is chronic, and it is accompanied by little pain. General antisyphilitic treatment ; locally, mercurial plaster.

3. *Tuberculous Caries* is found especially in children, and often results from an injury.

Treatment general. Locally ; hot fomentations with water or aluminium subacetate solution ; if there is abscess formation incision and drainage (*vide infra*).

B. If, in addition to the thickening there is a definite tumour with deep fluctuation, an **Abscess of the Orbital Margin** has formed. When this is of some size its greatest prominence lies somewhat lower than the margin itself, owing to gravitation of the pus. If there is at the same time pain and fever, it has probably arisen from a subperiosteal hæmatoma ; if the course is painless it is a cold abscess.

Treatment. After shaving the eyebrow and cleansing the skin with soap or soap dissolved in spirit, sublimate solution, and ether, an incision is made in a horizontal direction parallel to the line of the eyebrow at a dependent part, so as to avoid retention. The cavity is then packed with gauze and a dressing moistened with aluminium subacetate solution applied. The swelling and redness of the skin rapidly disappear, or if this does not occur a pocket or second abscess cavity in the neighbourhood is to be suspected, and a counter opening or second incision made.

If discharge of pus continues, and if bare bone is felt at the bottom of the abscess cavity, we investigate whether it is movable or not. If so, there is a sequestrum which must be removed when loose, after which the suppuration ceases, and in a short time the sinus heals by granulation.

If the abscess cavity has filled up with granulation tissue the recent scar should be protected with zinc or airol plaster, or adhesive plaster.

In tuberculous caries with abscess formation the wound must be kept open until the sequestrum has been removed.

C. A retracted cicatrix lies in the skin at the orbital margin, which is covered with granulation tissue and crusts. This is a

Sinus with a sequestrum, and may arise from injury or tuberculosis.

Treatment. Scraping out of the sinus and plugging with gauze. The sinus must not be allowed to close till the piece of necrotic bone has been thrown off or removed.

If cicatricial ectropion has been caused by the shrinking of the scar, the proper closure of the lids must be provided for. If the sinus has already completely healed, the callous tissue is excised, the lids sewn together temporarily, and the defect made good with a free or pedunculated graft (cf. Ectropion). If the sinus is still discharging, the operation is postponed until the sequestrum has been thrown off and healing has taken place. As a temporary measure the lid margins may be refreshed and sewn together.

D. If after an injury an unevenness or depression, with or without crepitation, is found in the orbital margin—most commonly in the outer half of the upper margin—a **Fracture** is diagnosed. It may be complicated with exophthalmos (*vide infra*).

The *Treatment* consists in antiseptic cleansing, suturing any wound which may be present, and a dressing moistened with aluminium acetate solution.

E. If a flat, more or less hard swelling is discovered under the outer half of the orbital margin, which, on deep palpation, is found to extend beneath the roof of the orbit, it is either an enlarged and inflamed lacrymal gland—**Dacryoadenitis**—or a **Periostitis of the orbital roof**. The latter is usually the result of syphilis, and runs a chronic, indolent course. General antisyphilitic treatment will be employed, and locally poulticing and mercurial ointment—the latter even in non-syphilitic dacryoadenitis. An abscess may form in either of these affections, and must be evacuated, packed, and dressed.

II. **Inflammation of the lids, combined with exophthalmos.** When the palpebral fissure is closed or considerably diminished in size, exophthalmos can only be perceived through the swelling on carefully separating the lids. This combination of symptoms always proves that there is in-

flammation of the orbital contents, whether diffuse (orbital cellulitis, phlegmon, abscess), or localised (tenonitis, panophthalmitis).

	General Symptoms.	*Differential Diagnosis*
(*a*) **Cellulitis orbitalis. Retrobulbar orbital Phlegmon** (or *Orbital Abscess* or *Retrobulbar Abscess*).	Subjective: Pain, fever, prostration, swelling of the preauricular glands; sometimes cerebral symptoms. Objective: Œdema of the lids and conjunctiva, chemosis.	Œdema of the lids and conjunctiva, and protrusion of the globe very marked as compared with the limitation of movement. In phlegmonous inflammation of the orbit, pointing of pus at one spot in the lids, with fluctuation.
(*b*) **Tenonitis.**	Protrusion of the globe straight forwards or to one side with consequent diplopia, limitation of movement, diminution of visual acuity. With the ophthalmoscope, papillitis, or, more rarely, retrobulbar neuritis (central scotoma); much venous hyperæmia of the disc and retina, thrombosis of the central vein.	Limitation of movement and chemosis very marked as compared with exophthalmos and œdema of the lids.
(*c*) **Thrombosis of the Cavernous Sinus.**		Œdema behind the ear, severe cerebral symptoms; frequently spreads to the other side.
(*d*) **Panophthalmitis.**		Keratitis, iridocyclitis, iridochoroiditis suppurativa. Usually follows wounds of the globe.

Ætiology. (*a*) *Orbital Cellulitis, Phlegmonous Inflammation of the Orbit.* Wounds with infection, including operations. Foreign bodies may remain embedded in the orbital tissues.

Infection from the neighbouring sinuses; empyema of the frontal, ethmoidal, or maxillary sinuses.

Infection from the skin : erysipelas, anthrax.

Infection from the bones : periostitis of the orbital walls, or maxilla.

Infection from the cavernous sinus : purulent thrombosis.

Metastatic infection : pyæmia, sepsis, typhoid, scarlatina, variola, meningitis.

(*b*) *Tenonitis.* Iridocyclitis especially traumatic, panophthalmitis ; traumatic from operations, especially strabismus operations. Primary : gout, influenza, rheumatism.

(*c*) Thrombosis of the cavernous sinus : 1. Marasmic. 2. purulent : orbital phlegmon, caries of the temporal bone, erysipelas, tonsilitis, dental caries. 3. Metastatic : pyæmia and the acute infectious diseases.

(*d*) *Panophthalmitis.* Suppurative iridochoroiditis. Endogenous or metastatic : pyæmia, meningitis, orbital phlegmon. Ectogenous : perforating wounds of the globe including operations ; corneal ulcers and fistulæ, cystoid cicatrices (so-called "late infection.")

The *treatment* in all these diseases consists in the application of hot fomentations, with the use of which either absorption is attained or suppuration is promoted. In the latter case the pus must be evacuated by deep incisions, which are followed by speedy relief from pain. The situation of the abscess and therefore of the incision, is determined by the direction in which the globe is displaced ; for instance, if it is pushed downwards and outwards the abscess is to be sought in the upper inner part of the orbit. After carefully cleansing the skin with soap, sublimate, and ether, a pointed bistoury is thrust as deeply as possible into the orbit, the point being directed towards the optic foramen ; drainage is then provided for, and the wound is dressed with iodoform or airol gauze, or a pad moistened with aluminium subacetate solution. If pus continues to come from the depths of the wound a sequestrum is to be suspected, or if there has been an injury and a wound is present, a foreign body. In the latter case the wound must be at once enlarged and the body removed after localising it, in the case of the metals, with the Röntgen rays. If, on the other hand, the suppuration and inflammation subside, the

wound should be gradually allowed to close from the bottom by shortening the strip of gauze or drainage tube at each dressing.

If a wound was the cause, the presence or not of a foreign body must naturally be investigated, and if one is found it must be extracted.

For the pain, narcotics and the withdrawal of blood, by 4 to 8 leeches to the temple, by Heurteloup's artificial leech, or by scarification of the œdematous swelling, are to be recommended.

In panophthalmitis a free incision in the sclera or transversely across the cornea and anterior part of the sclera is indicated, if pus is visible in the eyeball—yellow reflex from the pupil, hypopyon, yellow prominence in the sclera. By this measure pain is at once relieved. Hot antiseptic fomentations or wet dressings are then applied.

In all these diseases associated with exophthalmos, in addition to treating the cause, complications (*e.g.*, iritis) and sequelæ must not be forgotten. Above all, the lagophthalmos which results from the protrusion of the globe must be dealt with, best by a temporary partial sewing together of the lid margins. If, however, the globe itself participates in the disease—iridocyclitis, corneal ulcer, panophthalmitis—frequent inspection and local treatment with atropin are necessary, and therefore the palpebral fissure should merely be covered with gauze or with pieces of linen * smeared with boracic or iodoform ointment.

In traumatic tenonitis, especially after operations, cold compresses should be applied.

III. **Exophthalmos without inflammatory symptoms.**

I. *After injuries.* Combined with ecchymosis of the lids, with or without, at the same time a wound of the skin, and ecchymosis of the conjunctiva.

* A "hollow" dressing with a watch-glass or aluminium shell may be applied with advantage (Cf. Bandages, in the Introduction). In the present class of cases it acts as a moist chamber, prevents drying of the cornea, and, if a watch-glass be used, permits of continual inspection of the eye.

Hæmorrhage into the Orbit.	Common to both are the sudden onset and the traumatic cause.	*Differential diagnosis.* The protrusion of the globe cannot be diminished by pressure with the fingers.
Emphysema of the Orbit.		Exophthalmos may be diminished or made to disappear with audible and palpable crepitation on pressure; it returns, however, on forced expiration. It is usually combined with emphysema of the lids (*q.v.*).

The amount of loss of vision and limitation of movement depend upon the extent and situation of the lesion, and upon the amount of damage to muscles and nerves.

Fracture of the Orbit. If superficial this may be directly palpated in the orbital margin (*vide supra*); if deep, it can only be assumed from the accompanying hæmorrhage or emphysema.

The *treatment* consists in both cases in the application of a pressure bandage—moistened with alumininium subacetate solution or aq. plumbi in the case of hæmorrhage, dry in the case of emphysema. In the latter instance also, the patient is warned to avoid severe bodily exertion, coughing, sneezing, straining at stool, etc., and, in order to lessen these, laxatives and cough mixtures are given as required.

An open wound must naturally be treated according to surgical principles. If the history makes it possible that a foreign body has entered the orbit, it must be sought by probing and the Röntgen rays, and if found extracted. Only small foreign bodies (small shot) with clean wounds of entrance may be left without harm, provided that they are not in contact with any important tissue—*e.g.*, if they lie on the floor of the orbit.

II. *Arising spontaneously.* (*a*) *Suddenly.* 1. **Hæmorrhage into the orbit.** In severe coughing—especially in whooping cough, arteriosclerosis, hæmophilia, scurvy. It is characterised by the subsequent appearance of visible ecchymosis, especially

of the lower lid. The exophthalmos cannot be diminished by pressure.

Treatment. Pressure bandage with aq. plumbi or dilute aluminium subacetate solution. If the exophthalmos is so great that the lids cannot be completely closed, they should be temporarily sewn together.

2. **Exophthalmos pulsans** = Arterio-venous aneurism of the cavernous sinus from tearing of the carotid within it.

Differential Diagnosis from 1: Dilatation of the conjunctival and palpebral vessels; subjectively and objectively audible whizzing and buzzing noises synchronous with the pulse; sometimes visible pulsation; exophthalmos may be diminished by local pressure or by compressing the carotid; in the latter case also the noises cease.

Treatment. Methodical compression of the carotid for as long a period each day as the patient can bear; this must be continued for many weeks. If without result, the carotid of the same or of both sides must be ligatured, a proceeding which is not contradicted by advanced age, if the general nutrition is good. It should be done when possible under cocain anæsthesia so as to avoid the weakening action of chloroform on the heart.

(*b*) *Exophthalmos of Gradual Onset.* **Tumours** and **Entozoa** (*echinococcus, cysticercus*) **of the Orbit, Exophthalmos intermittens.**

Tumours may be congenital, but yet commence to grow in later life (dermoid cysts, angiomata, meningoceles), or they may arise after birth (sarcomata, carcinomata, osteomata, lymphomata, entozoa, exophthalmos intermittens, etc.).

The situation of the tumour, if not at once obvious, can in most cases be determined by carefully pressing it with the finger through the lids, a general anæsthetic being given if necessary. It is always difficult to determine the nature of the tumour, but attention to the following points will be of assistance. Fluctuation is in favour of *Cysts* or *Entozoa.* The tumour is very soft, but with somewhat harder, tortuous cords palpable in it; it can be diminished in size by pressure, but swells on crying, straining, etc. (this may be the only sign

available for diagnosis in deep-seated retrobulbar tumours); the vessels in the lids and conjunctiva are dilated, or the tumour itself has a bluish colour :—*Angioma.* The tumour is stone-hard and springs usually from the frontal bone, often after an injury :—*Osteoma.* The tumour is cystic, situated between the globe and the orbital wall, and of slow growth :—an *ecchinococcus* or *cysticercus cyst* is to be suspected and the diagnosis will be confirmed if, on exploratory puncture, a non-albuminous fluid containing hooklets is evacuated.

If the exophthalmos is spontaneously intermittent and can be voluntarily induced by straining, bending forward the head, or compressing the jugular vein, the condition is *Exophthalmos intermittens.*

Situation of the tumour at the upper inner, or more rarely at the upper outer, angle of the orbit is characteristic of congenital *dermoid cysts* and *meningoceles.* In this case the differential diagnosis is of much importance from the point of view of treatment (*vide infra*). The following are shortly the points which may be relied upon.

Meningocele. Firmly attached to the bone, in which a gap can often be felt; it can therefore not be moved upon its base. Its size may be diminished by compression, sometimes with the production of cerebral symptoms—giddiness, nausea, convulsions; spontaneous variations synchronous with the respiration or pulse may be noted. In cases which still remain doubtful, an exploratory puncture may be performed, when a clear albuminous fluid will be evacuated.

Rapidly growing tumours with much displacement of the globe are probably malignant. Tumours of the optic nerve (*q.v.*) usually cause protrusion straight forwards.

Treatment. Orbital tumours should be removed. If malignant, this must be done at once and most thoroughly, and the eyeball must be sacrificed, even when the vision is good. The other tumours, if sharply circumscribed, may be extirpated with retention of the globe, even when retrobulbar in situation, by temporary division of the straight muscles or resection of the outer wall of the orbit (Krönlein's method). *Meningoceles should not be operated upon.* Superficial angiomata involving

the lid may be destroyed by electrolysis in several sittings. A flat anode is applied to the back of the neck or to the temple, and the current is closed by plunging the kathode, armed with a stout steel needle, into a supplying vessel. Bubbles of hydrogen, mixed with blood, should arise freely at the point of puncture. In a short time—1 to 2 minutes in the case of comparatively small vessels—the hæmorrhage will cease from coagulation of the blood. At each sitting a few such punctures are made, beginning at the periphery of the tumour and gradually proceeding towards the centre. In this manner, with patience and perseverance on the part of the surgeon and patient, any teleangiectasis which does not extend too deeply into the orbit may be destroyed. It is necessary, however, to deal in the same manner with any dilated vessels appearing latter. This method is applicable even to little children, in whom it should be carried out under general anæsthesia. Sharply circumscribed tumours are less tediously treated by excision.

Enophthalmos. *Ætiology*. 1. Disappearance of the orbital fat in great emaciation.

2. Paralysis of the sympathetic. (Cf. Horner's Symptom Complex.)

3. Traumatic, either from fracture of the floor of the orbit, or from atrophy of the orbital tissues, the result of nerve lesions or cicatricial contraction.

4. After the spontaneous cure of an Exophthalmos pulsans.

5. In neurotic facial atrophy and in ophthalmomalacia.

6. Congenital.

Treatment is for the most part of no avail. An attempt might be made to bring the globe somewhat forward by dividing all the straight muscles and so weakening or destroying their tonic pull. The recent method of vaselin or paraffin injections may also be used to overcome or lessen the cosmetic defect.

Exophthalmos is merely a symptom, but in its higher degrees demands treatment per se on account of its harmful sequelæ—catarrh, epiphora, lagophthalmos, keratitis, ectropion of the lower lid, limitation of movement of the globe, diplopia.

Ætiology. (*a*) From increase of the orbital contents : foreign bodies, blood, air, tumours, inflammatory exudation in the connective tissues, panophthalmitis, tenonitis, arteriovenous aneurism of the carotid (exophthalmos pulsans), abnormal tortuosity of the orbital veins (exophthalmos intermittens).

(*b*) From lessening the orbital capacity : thickening of the walls in consequence of chronic—usually syphilitic—periostitis, dilatation of the neighbouring air sinuses.

(*c*) From diminution of the tone of the straight muscles—*e.g.*, after tenotomy. After tenotomy of the internal rectus, the caruncle is also sunken.

(*d*) Graves's disease.

The *treatment* must naturally deal with the cause. In the slighter degrees the sequelæ are to be guarded against by the application at night of a dressing smeared with ointment ; in more advanced cases by shortening the palpebral fissure in the horizontal direction by a tarsorrhaphy, or by partially or completely sewing the lids together.

When the sequelæ have already occurred, they are to be treated by appropriate means. (Cf. especially Ectropion and Keratitis.)

Injuries of the Orbit concern either the soft parts alone, with or without simultaneous injury of the globe, or the bony walls ; or both may be affected together.

The diagnosis can only be made with certainty in the case of punctures of the orbital margin by the finding of a localised depression tender to pressure and giving crepitation. In other cases it must be assumed from the symptoms—penetrating wounds, ecchymosis of the lids and conjunctiva, enophthalmos or exophthalmos, emphysema, limitation of movement, decrease of visual acuity, ophthalmoscopic changes, etc.

The point of greatest importance in the *treatment* is whether or not a foreign body is present. If one is found, it must be removed, if not, the wound is to be cleansed with antiseptics, drainage provided for by a tube or strip of gauze, and an antiseptic dressing applied. Inflammatory complications in the eyeball must naturally be treated (for further details see above).

THE OCULAR MUSCLES

DISTURBANCES OF BALANCE OF THE EXTERNAL MUSCLES

1. These may not be obvious in ordinary circumstances, but manifest themselves only by exhaustion from overstraining of a muscle relatively too weak for its antagonist (*Asthenopia muscularis*).

Insufficiency (*latent or dynamic strabismus, heterophoria*). This affects the rectus internus, or more rarely the rectus externus—latent strabismus divergens (exophoria) or convergens (esophoria).*

In muscular asthenopia the patient complains of speedy exhaustion on near work; the object fixed becomes indistinct, and flickers and dances before the eyes; or it may become doubled. With this there is frontal headache, or even sickness and vomiting, after using the eyes for a short time in near work.

The diagnosis can only be made by trial with prisms after the method of Albrecht and Alfred Græfe (for details see the text-books).

The *treatment of insufficiency* consists first in an attempt to strengthen the internal rectus; systematic exercises with the stereoscope; constant current (1 to 2·5 milliampères from three to six minutes), the kathode being applied either directly over the muscle after cocainising the conjunctiva, or through the closed lids in the corresponding situation; or near work may be entirely given up for four to six weeks, while the general health is improved. Prisms, without being curative, relieve the symptoms; the base should be inwards in insufficiency of the

* The superior or inferior rectus may also be affected (hyperphoria.) —Trs.

interni, and outwards in the case of the externi; on account of their weight, not more than 6 to 8 degrees can be used, distributed between the two eyes. The prisms ordered for near work should not quite correct the total amount of heterophoria.

In high degrees of exophoria, which occur usually in myopes, the annoyance may be diminished by combinations of prisms and spherical concave glasses, but if there is also exophoria for distance, tenotomy of the external rectus will be required. In esophoria of high degree this should be preferred to other methods on account of its more certain results.

2. The disturbance of balance may be always manifest as a visible squint.

Strabismus concomitans. Any one of the four straight muscles may be affected—strabismus convergens, divergens; sursum-, deorsum-vergens. The degree of squint may be marked out in linear or angular measurement (for methods see the text-books). The range of movement of the squinting eye is diminished towards the side of the antagonist only in cases of very high degree—a point of difference from paralytic strabismus. Diplopia is quite exceptionally observed, and when present the two images remain the same distance apart in whatever direction the patient looks. The squinting eye is usually amblyopic, but on the other hand, an eye with good visual acuity may become amblyopic as a result of the strabismus.

Treatment. This depends chiefly on the condition of the refraction, which must be determined in all cases after paralysing the accommodation. If hypermetropia is present while the squinting eye has normal or approximately normal vision, the *full* correction (including astigmatism) should be given for constant wear; the glasses must especially never be left off for near work.

If the squinting eye has poor vision an attempt may be made, after correcting the ametropia, to strengthen and exercise it by covering up the good eye for half an hour several times a day. This is chiefly applicable to young children. At the same time stereoscopic exercises may be employed,

provided that the visual acuity is not too low. A permanent cure is, however, seldom to be expected by this method. Usually a tenotomy of the abnormally powerful muscle or an advancement of its antagonist is necessary ; or these two operations may be combined or a tenotomy performed on both eyes.

Strabismus divergens is usually associated with myopia, especially with the higher degrees. In this case operation is always necessary—advancement of the internal rectus with or without tenotomy of the external.

3. **Paralysis of the Ocular Muscles.**

Symptoms. *Limitation of movement* and *diplopia* on looking in the direction which the paralysed muscle normally gives to the eye. The distance between the images increases the farther the patient looks towards this side. *Squint* (*strabismus paralyticus*) in old paralysis from contracture of the antagonists : in this case the secondary deviation (*i.e.*, the deviation in the sound eye when the patient fixes with the paralysed) is greater than the primary, and not, as in concomitant strabismus, the same. *False projection* of objects with the paralysed eye—they are supposed to be farther in the direction of the paralysed muscle than they really are. *Giddiness.* *Peculiar manner of holding the head*—it is turned round towards the paralysed muscle.

For the special diagnosis of the muscle affected the larger works must be consulted.

Treatment. In the first place the cause must be attacked. The lesion may be situated in the orbit (injuries, affections of the bony walls, tumours), in the base of the skull (periostitis, pachymeningitis, tumours, etc.) ; in the course of the nerve fibres within the pons, or in the nuclei. Antirheumatic and antisyphilitic treatment will be employed as indicated, and electricity (constant current of 1 to 2·5 milliampères. Cf. Insufficiency). In order to diminish or get rid of the subjective annoyance caused by the diplopia the paralysed eye may be occluded with a ground glass, or a bandage, or a prism may be used with its base towards the paralysed muscle. When the paralysis has become permanent or contracture of the antagonist is setting in, an operation must be performed—tenotomy

of the antagonist in the affected eye or of the synergic muscle in the other eye, or advancement of the paralysed muscle.

INTERNAL MUSCLES.

Sphincter pupillæ. *Spasm*, *Paralysis.* (Cf. Mydriasis and Myosis.)

Ciliary Muscle. *Spasm of the accommodation* simulates myopia or increases it if present. Macropsia, myosis.

Treatment. Atropin for weeks or months. Tonics.

Paralysis of the Accomodation manifests itself by recession of the near point. To distinguish it from presbyopia : the degree of the latter corresponds to the age of the patient, it comes on gradually, is always bilateral, and is not associated with mydriasis, as paralysis of the accommodation often is. The range of accommodation must always be determined.

The *Symptoms* are like those of asthenopia. They vary according to the state of the refraction, being most marked in hypermetropia. Sometimes there is micropsia.

Treatment. The cause is combated. Convex glasses may be prescribed in order to enable the patient to do near work ; they are gradually made weaker as the condition is recovered from. Eserin, pilocarpin.

APPENDIX

Local Anæsthetics

Acoïn C. As an instillation in 1% solution. It does not affect the pupil, the accommodation, or the vascularity of the conjunctiva. The anæsthesia lasts for $1\frac{1}{2}$ to 2 hours. The solution must be kept in the dark and should be preserved in a bottle which has been rinsed with hot hydrochloric acid and washed out with distilled water.

It is also used in 0·1% solution as an addition to subconjunctival injections of 5% salt solution, or 1 in 2000 or 3000 hydrarg. cyanid. solution. It cannot be combined with the other mercury salts or with iodine preparations since the acoïn is precipitated. Such injections are used in keratitis interstitialis, iridocyclitis, and detachment of the retina.

Cocain. 1—3—5 % solution as an instillation or as an addition to subconjunctival injections (cf. Introduction). It dilates the pupil moderately, and causes anæmia of the conjunctiva and iris. It is used in all operations. In combination with dry atropin it produces the greatest possible mydriasis (cf. Iritis). Cocain is still the most useful anæsthetic in ophthalmology, the next in order being holocain and tropacocain. (*Vide infra.*)

Dionin is used as a solution (10 to 15 %), as an addition to ointments (5 to 10 %, *vide infra*), and in substance, for photophobia, conj. phlyctenulosa, keratitis, corneal cicatrices (to obtain clearing), scleritis, iridocyclitis, choroiditis, vitreous opacities.

It causes œdema of the conjunctiva, or even of the lids, from lymphatic congestion, but this soon passes off ; after prolonged

use this reaction is absent or slight. The patient complains of much burning, but this also quickly disappears.

The surgeon should, if possible, make the first application himself, so that he may watch the reaction and reassure the patient, who is often alarmed at its severity. It may be prescribed in combination with cocain, pilocarpin, eserin, atropin, or scopolamin.

Eucain B. In 1 to 2 % solution this does not cause mydriasis or paralysis of the accommodation, but it is not well borne in iritis and scleritis. Its instillation produces pain.

Holocain hydrochloride. 1 % solution; its action is more rapid than that of cocain, and it is antiseptic.

Tropacocain hydrochloride. A 1 to 5% solution, best with 0·6 % salt solution, is employed as an instillation. Not more than 0·03 grm. (gr. ½) can be used in injections on account of the danger of poisoning. It is cheaper and more stable than cocain, and anæsthesia occurs more rapidly and lasts longer.

Subconjunctival Injections

Used in keratitis, iridocyclitis, vitreous opacities, retinitis, choroiditis. (Cf. Introduction.)

1 in 1000 Hydrarg. perchlor. (0·2 to 0·3 cc.—m. 4 to m. 5)
1 in 5000 Hydrarg. cyanid. with 2 % sodium chloride (0·25 to 1 cc.—m. 4 to m. 15)
2–5–10 % Sodium chloride (0·5 to 1 cc.—m. 8 to m. 15)
1 % Hetol (0·5 to 1 cc.—m. 8 to m. 15)
10 % Iodipin (0·2 to 0·5—m. 4 to m. 8).

} with the addition of 2 % cocain or 0·1 % acoïn.

℞ Iod. pur. . . . . 0·01–0·02
Potass. iodid. . . . . 2·0
Aq. destill. . . . . 30·0
Sig. 1 cc.—m. 15.

Intramuscular Injections

In syphilitic lesions (*vide* p. 9).

Astringent Collyria

1. ¼ to ½% Argent. nitrat.
2. 1 % Alum.
3. Collyr. astring. lut. (*vide* p. 70), pure or with aq. destill. āā.
4. ¼ % Cupr. sulphat.
5. 3 to 6 % Sodium sozoiodol.
6. ½ to 2 % Plumb. acetat. basic.
7. 2 to 10 % Protargol.
8. 1 % Tannin.
9. 1 to 2 % Zinc. sozoiodol.
10. 1 % Zinc. sulphat.
11. 7 to 8 % Aluminium subacetate (Burow's solution) diluted 1 to 5–10.

Other Collyria

Adrenalin hydrochloride 1 in 1000, in combination with cocain, etc., is useful in operating upon eyes with much injection from its vaso-constrictor action. It also eases the itching of conjunctivitis.

℞ Acid. acet. dil. . . . gt. 1
Aq. destil. . 10 to 20 cc. (dr. 3 to dr. 6) } for the itching of spring catarrh.

1 % Atropin. sulphat.
¼ to ½ % Scopolamin. hydrobrom.
¼ to ½ % Duboisin.
1 to 2 % Euphthalmin. hydrochlor.
1 % Homatrop. hydrobrom.
} Mydriatics.

The action of the last two is of shorter duration than in the case of the others, and they are chiefly used in making ophthalmoscopic examinations.

½ to 1 % Pilocarpin. hydrochlor.
½ to 1 % Eserin. (sive Physostigmin.) sulphat.
½ to 1 % Eserin. (sive Physostigmin.) salicylat. (more stable).

℞ Eserin. sulphat. (sive salicylat.) . 0·30
Acid. sulphuros . . . . gtt. 1–2
sive Acid. boric. . . . . 1·0
Aq. destillat. . . . . 30·0

} Myotics.

Eserin keeps better in the above formula than in simple solution. Pilocarpin and eserin may with advantage be combined with one another or with dionin.

℞ Eserin. sulphat. . . . . 0·02
Pilocarpin. hydrochlor. . . . . 0·05
Aq. destill. . . . . 10·0

℞ Eserin. . . . . 0·02
Pilocarpin. . . . . 0·2
Cocain. . . . . 0·05
Dionin. . . . . 0·2
Aq. destill. . . . . 10·0

Jequiritol (in Pannus) cf. p. 68.

Infus. jequirity (in Pannus) cf. p. 68.

Solutions for Painting the Conjunctiva

Used in various forms of acute conjunctivitis.

2 % Argent. nitrat. (subsequent douching with water or salt solution). (Cf. p. 45.)

5 to 10 % Argentamin (subsequent douching).

3 % Ichthargan (no subsequent douching).

10 % Largin (no douching).

10 to 20 % Protargol (no douching).

10 % Itrol (no douching).

20 % Nargol (no douching). It causes very little pain.

10 % Argyrol.

Powders for Insufflation

Calomel. lævigatum. Must be kept dry. Used in conj. phlyctenulosa.

Xeroform (Conj. phlycten., vernal catarrh, instead of iodoform on wounds of the lids or globes).

Airol (wounds of lids or globe, phlyctenules).

Europhen (catarrh. chronic., catarrh. sicc.).

Gallicin (catarrh).

Itrol (blennorrhœa of the conjunctiva).

℞ Tannin. . . . . 1·0
Ac. boric. . . . . 3·0 } (Trachoma).

Dionin (Photophobia, inflammation of the cornea iris, and, choroid).

Solutions for Douching the Conjunctival Sac

Potass. permangan. (*vide* p. 53) . . 1 in 5000
(Cf. Kalt's irrigation)
Hydrarg. perchlor. . . . . 1 in 4000
Chinosol . . . . . 1 in 4000
Hydrarg. cyanat. . . . . 1 in 500
Itrol . . . . . 1 in 2000
} (In blennorrhœa and diphtheria of the conjunctiva.)

Acid boric. 3 in 100 (hyperæmia and catarrh of the conjunctiva).

For Painting the Lid Margins

(In Blepharitis.)

Neutral soap
Tincture of benzoin emulsified in water

℞ Ac. boric. 3–5
sive Ac. salicylat. . . . 1–2
sive Resorcin. 1–2
Spir. vin. . . . . 100·0
} (Hyperæmia of the lid margins, Blepharitis squam., oleos.).

℞ Ol. fagi.
sive Ol. rusci.
Ol. oliv. . . . . āā 10·0

℞ Pic. liquid.
Spir. vin. . . . . āā 10·0

℞ Bals. peruv. 15–25
Spir. æther. 50
} (Phthiriasis palpebr.)

10 to 20 % Argent. nitrat. (wiped off with cotton wool dipped in salt solution)
1 % Picric acid solution (wiped off with cotton wool dipped in salt solution)
} (Bleph. ulcerosa).

Ointments for the Lids

℞ Acid. salicyl. . . . . 0·1
sive Acid. boric. . . . . 0·3
sive Hydrarg. ammoniat. . . 0·1
Vaselin. flav. puriss. . . . 10·0
Misce exactissime.
} (Hyperæmia of the lid margins, Bleph. squamosa).

℞ Iodoform. pulv. . . . 0·30–0.50
sive Airol. . . . . 0·30–0·50
Vasel. flav. puriss. . . . . 10·0
Misce exactissime.
(Vaccinia, burns or wounds of the lids).

℞ Bals. peruvian. . . . . 2·0
Vaselin. . . . . 6·0
(Blepharitis acarica).

℞ Airoli . . . . . 0·5
sive Hydrarg. oxid. flav. . 0·1–0·5–1·0
sive Resorcini . . . 0·05–0·2
sive Ichthyoli . . . . 0·25–0·5
Vaselin. . . . . 10·0
(Blepharitis ulcerosa).

Eye Ointments

℞ Plumb. acetat. perfecte neutralis. 0·15
Vasel. flav. purissim. . . . 5·0
(Follicular catarrh).

℞ Acid. boric. . . . . 0·3
Vasel. flav. puris. . . . 10·0
(Recent corneal scars, wounds of conjunctiva).

℞ Hydrarg. oxid. flav. . 0·1–0·5
Vasel. flav. puriss . . . 10·0
Misce exactissime
(For clearing corneal cicatrices, phlyctenular conjunctivitis).

The latter ointment may, with advantage, have 3 to 10 % dionin added in cases of deep corneal opacities, especially after keratitis interstitialis.

℞ Cupri sulphat. . . . . 0·05
sive Cupri citrat. . . . 0·5–1·0
Ung. glycerin.
sive Vaselin. flav. puriss. . . 10·0
(Trachoma, trachomatous pannus).

℞ Tannin. . . . . 1·0
Ung. glycerin. . . . . 20·0
(Trachoma).

℞ Iodoform. subtil. pulv.
sive Xeroform.
sive Airol. . . . . 0·3–0·5
Vasel. flav. puriss. . . . 10·0
(Corneal ulcers, phlyctens, wounds of the conjunctiva, Pemphigus conj.).

℞ Atropin. sulphat. . . . . 0·10
Hydrarg. perchlor. . . . 0·025
sive Airol. . . . . 1·0
sive Iodoform. . . . 1·0–2·0
sive Acid. boric. . . . . 0·6
Vasel. alb. . . . . 20·0
Misce exactissime.
} (Corneal ulcers).

Dionin 5 to 10 % may be added to the above.

℞ Hydrarg. perchlor. . . 0·01
Vasel. alb. . . . . 30·0
} (Vernal catarrh).

℞ Extract. belladonnæ . . 0·5
Ung. cinereum. . . . 5·0
} (For inunction on the forehead in neuralgia, iritis, etc.)

℞ Airol . . . . . 5·0
Linim. exsicc. Pick.
Kaolin. . . . . āā 10·0
} (Protective paste for wounds of the lids, etc.)

The formulæ for ointments and powders which do not belong especially to ophthalmology, but are employed in other diseases which happen to be situated in the neighbourhood of the eye (*e.g.*, eczema, herpes zoster, neuralgia of the trigeminal, etc.), have been fully given in the text.

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